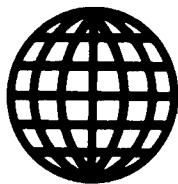


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# ***JPRS Report***

# **Science & Technology**

***Europe & Latin America***

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# SCIENCE & TECHNOLOGY

## EUROPE & LATIN AMERICA

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## ITALIAN SUPERCONDUCTIVITY RESEARCH, FACILITIES DESCRIBED

Rome SCIENZA DUEMILA in Italian No 6, Jun 87 p 45

[Article by Sergio Zanella: "Superconductors at CISE and Elsewhere"]

[Excerpts] CISE [Center of Information Studies and Experience] (a joint-stock research company, with ENEL [National Electric Energy Agency] as major shareholders, based in Segrate and involved in the development of advanced technology) has had a cryogenics laboratory specially equipped for the study and definition of the characteristics of superconductive materials for more than 10 years. The laboratory was set up in 1974 to evaluate the possible applications of superconductors in the transport of electric energy and in the development of an innovative alternator. The laboratory is equipped with cryostats to permit operation at temperatures starting from the temperature at which liquid helium boils ( $T=4.2K$ ), even in the presence of extremely high intensity (120,000 gauss) magnetic fields. With these instruments it is possible to define the characteristics of superconductor materials by measuring the critical current, critical temperature, etc. This laboratory also has equipment -- unique in Italy and one of the few in existence in the world -- for evaluating the electrical losses and magnetization of superconductors.

In collaboration with ENEA [National Committee for Research and Development of Nuclear and Alternative Energies], the transitory magnetic behavior of superconductor compounds is currently being studied for use in the construction of the toroidal magnet of the NET [Next European Torus] machine for the study of thermonuclear fusion which is to be produced soon.

The laboratory and its activities have made it possible to prepare, over a short period, the new superconductor material composed of Y-Ba-Cu-O, and on 26 March 1987 the first transition to the superconductor state at temperatures higher than that of liquid nitrogen was observed. Since then, various samples have been produced by improving the method of preparation. It is planned to conduct studies for defining the characteristics of the material using SEM [Scanning Electron Microscope] and X-diffraction techniques, in addition to ESCA [Electron Spectroscopy for Chemical Analysis] and AUGER analyses. In particular, the definition of the electrical and magnetic characteristics of the material is planned in order to identify the most promising sectors for its application.

ENEL, which financed the work on superconductivity from 1974 to 1983, is now displaying a renewed and more pronounced interest, and is encouraging CISE to continue its research on this strategic frontier.

In the Soviet Union, Professor Golovashkin of the Physics Institute of the USSR Academy of Sciences has discovered a material which shows a dramatic reduction in resistance over a range going from -100 C to -23 C; however, this [phenomenon] proved to be a one-time event that it has not been possible to reproduce.

The first important application of high temperature ceramic superconductors will preobably be in electronic components, and these should already be on the market within 1 year. For large-scale applications such as the production, transmission, and storage of energy, it will be necessary to wait much longer. In the past it has been seen that in the development of new materials at least 10 years are necessary between the laboratory phase and the phase of large-scale commercial application.

[Box insert, p 45]

#### Italian Manufacturers

Who is working on high temperature superconductivity in Italy?

The first Italian laboratory to "cook" metal oxides to produce a ceramic superconductor material (a mixture of barium, yttrium, copper, and oxygen) was that of the Institute for Research in Non-Traditional Materials of the CNR [National Research Council] based in Cinisello Balsamo. Production of the first superconductor plastics took place in mid-March and precise measurements of the characteristics of the new materials were carried out at Genoa University. At the end of March, the CNR Solid State Electronics Institute in Rome, a group working on low temperatures and superconductivity, produced more tablets whose atomic structure and other characteristics were studied at ENEA in Frascati and with the "synchrotron light" of the INFN (National Institute of Nuclear Physics). ENEA also has laboratories and groups that have been working for years on low temperatures and superconductivity, and at the Casaccia [facility], near Rome, the famous tablets are being produced. Since ENEL also is interested in superconductivity because of the possible large savings in energy transmission, this agency has started to experiment with superconductor ceramics through CISE.

Naturally, a number of universities also are following these studies, even though their laboratories often lack the necessary equipment for this kind of experimental work. The problem now is to coordinate all these branches of research which were begun independently, and to establish a link with industries already specializing in superconductivity (such as Ansaldo and LMI).

8627

CSO: 3698/M327

## BRIEFS

ANSALDO SUPERCONDUCTOR APPLICATIONS CENTER--Ansaldo has set up a "Superconductor Applications Development Center" which is to operate within the Ansaldo research structure and is divided among two centers, one in the Boschetto laboratories in Genoa, and the other in the Naples area. To help in the definition of the center's program, a technical and scientific committee has been set up which is presided over by Professor Carlo Rizzuto, lecturer in solid-state physics at Genoa University and head of the Interuniversity Association for the Physics of Matter. In addition to the Ansaldo experts, which included center director Angelo Dufour, the first meeting of the committee was attended by representatives of IRI [Institute for the Reconstruction of Industry], Finmeccanica, CISE (the ENEL [National Agency of Electric Energy] Center of Information Studies and Experience), ENEA [National Committee for Research and Development of Nuclear and Alternative Energies], the National Institute of Nuclear Physics, the CNR [National Research Council] Institute for Non-Traditional Materials Technology, the physics departments of Naples and Salerno Universities, the electrical engineering department of Genoa University, and several private firms operating in the sector. The program and objectives of the center are concerned both with the development of high temperature superconductor materials and with their possible applications in the production, transmission, distribution, storage, and utilization of electric energy in the energy and transportation sectors and in industry. [Text] [Rome FINMECCANICA NOTIZIE in Italian No 5, 31 May 87 p 11] 8627

CSO: 3698/M328

## DFVLR ISSUES PROPOSAL FOR NATIONAL AEROSPACE COMMISSION

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457,  
12 Jun 87 p 3

[Text] In order to improve management of aerospace research and development, the German Research and Experimental Institute for Aeronautics and Astronautics (DFVLR) has presented proposals to establish a "National Aerospace Commission." According to Professor Walter Kroell, the new president of the DFVLR and former president of Marburg University, the proposals are based on a "hierarchic" form of agency: a permanent interministerial committee in cooperation with a highly qualified staff is proposed to form a politically controlled National Aerospace Commission led by the Federal Minister of Research or by the FRG Government's permanent coordinator of aeronautics and astronautics, Erich Riedl of the Christian Socialist Union (CSU), who is the parliamentary secretary to the Ministry of the Economy.

[According to Professor Kroell,] the planning of aerospace activities, which is strictly controlled by the commission as the budget, will be organized by a national program and project organization within the DFVLR.

The Industrieanlagen-Betriebsgesellschaft (IABG) in Munich has recently examined possibilities for improvement of the organizational structure of the aerospace industry. The proposals ranged from the setting up of a special aerospace agency based on the American model (NASA), to improvements in the respective ministries.

According to Kroell, the main advantage of the DFVLR model over the proposals of the IABG lies in the decisive strengthening of political control, while the IABG model confuses functions of political control and technical execution (Model 1 of the IABG report). The withdrawal of program and project execution functions from the DFVLR (Model 2 to 5 of the IABG report) would be, according to the DFVLR, too costly and personnel-intensive with regard to the setting up of an infrastructure.

8707

CSO: 3698/M320



## FRG ECONOMIC MINISTER SETS RULES FOR AIRBUS SUBSIDIES

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457,  
12 Jun 87 p 5

[Text] On the basis of 129 orders and options, Deutsche Airbus GmbH applied at the end of April 1987 to the FRG Government for financing of the A330/A340 project. To meet and complete the resolutions already made -- for which the necessary budgetary conditions still must be created by parliament -- Federal Economic Minister Bangemann has now planned the following measures:

- The development of the A330/A340 project will be financed with grants of up to DM2.996 billion between 1988 and 1996. The grants shall be repaid on completion of sales. In this regard, Deutsche Airbus GmbH has been able to claim adequate economic prospects for the project as well as the possibility of dividends for the FRG Government in excess of the repayments. Due to the risks involved in the project and the difficulties envisaged by the industry with regard to financing of series production, the existing rate of financial support amounting to 90 percent of the development costs has been retained.

- In contrast to the promotion of a series of financial aids for large programs, a government guarantee is not planned for the A330/A340.

- In conjunction with the government guarantee for the A300/A310 programs, the FRG Government will provide a total of DM1.906 billion between 1988 and 1994 in the form of reimbursable subsidies. Airbus Industry is expected to contribute to the profitability of the A300/A310/A320 programs by reducing costs to the greatest possible degree.

As a condition of its support, the FRG Government requires that the extended Airbus Program is capable of competing on a long term basis against American manufacturers, who presently dominate 80 percent of the international market.

8707

CSO: 3698/M321

## BMFT EVALUATES RESULTS OF SUBSIDIES FOR BIOTECHNOLOGY PROJECTS

Bonn TECHNOLOGIE NACHRICHTEN-PROGRAM INFORMATIONEN in German No 401, 1 Jun 87  
pp 2-16

[Unattributed article: "TheFRG's Research Program'Applied Biology and Biotechnology'; A Preliminary Appraisal of BMFT Subsidies in the Years 1985 and 1986"]

[Text] A. Theme Specific Cooperative Research

The subsidy of theme specific cooperative research in applied biology and biotechnology is above all governed by research policies on the development of key technologies, improvement of the prerequisites for innovation in the economy, and solutions to present and future government tasks, for example in environmental research.

In biotechnology the introduction of innovative processes is successful when multiple technical approaches are developed involving widely varying disciplines such as microbiology, cell biology, molecular biology, chemistry, and process technology. By concentrating R&D capacities in terms of a strengthened application of cooperative research principles and strict selection from the point of view of quality, research subsidies in biotechnology have made a great contribution to the development of a self sufficient technology base and consequently to the heightened competitiveness of German industry, to decreased resource requirements, and to reduced environmental stress.

The following objectives have been emphasized in subsidies for cooperative research since the biotechnology program was approved:

- the development of biological and biotechnological processes and programs;
- the development of biotechnological solutions to problems in the area of medicine, agriculture, and environmental research;
- the expansion of personnel capacity for biological research both in the public domain and in industry.

The main themes were selected from two points of view. Sometimes definitions of the theme content resulted directly from the definition of biotechnology. But because subsidies are not meant for every sector, the possible themes were

filtered again to select those which were particularly attractive scientifically, or were necessary from the point of view of present or future government precautions.

For the selection of suitable themes, the results of consultations with national and international panels were evaluated, as were the results of hearings, for example regarding the project theme "Regenerated Raw Materials." In 1986, several expert panels of the FRG's Ministry for Research and Technology [BMFT] presented opinions regarding cooperative projects that were particularly worth subsidizing.

The range of subsidized themes apply to the actual state of the art in science and will be modified as scientific understanding advances. This refers particularly to the area of agricultural research, where biotechnological methods and processes will make major contributions to the solution of current and long term problems.

In 1986, the main subsidy efforts were made in:

- technology for microbiological and microbe genetics;
- cell culture and cell fusion technology;
- bioprocessing and enzyme technology;
- research on plants and animals;
- safety research.

With a view toward future developments, new areas of applied biology with innovative potential, such as bioelectronics, enzyme design, and protein engineering have been included for subsidies.

From the range of priority subsidy fields, several limited teams of themes have been selected and are presented in the following:

## 1. Microbiology

### 1.1 Topic: Microbiological Screening Methods

The objective of this topic is to expand the spectrum of technically interesting microorganisms which either form products to be used in industry, or transform or decompose organic materials. In 1986, the program for "Microbiological Screening Methods by Production Families" was announced and the first cooperative projects are in preparation. Among the topics covered were chemotaxonomy, rapid identification methods for organisms, and production oriented selection and breeding of archeobacteria.

### 1.2 Topic: Waste Water, Waste, and Soil Microbiology

In the area of anaerobic waste water purification, subsidies are concentrated on organically highly stressed chemical waste, for example, waste water from the manufacture of basic plastic products. Among other things, a cyclic separation method will be developed, which allows an economical separation of microorganisms. Other projects are developing biotechnical waste water treatment processes for industrial waste water that is heavily polluted or

burdened by persistent environmental chemicals such as those encountered in dairies, breweries, and pulp or waste paper mills. Basic research on microbiological degradation provides the prerequisites and forms an integral part of the project. Another main emphasis is on the development of processes to eliminate nitrogen from heavily burdened waste waters. In this regard, development of suitable bioreactors and the breeding of suitable starting cultures has been planned.

In the area of biologically sanitizing contaminated soil, subsidies concentrate on developing a process for on-site purification of highly permeable soils that are contaminated with polycyclical aromatic hydrocarbons. A research team, "Biological Transformation of Dioxin-based Compounds" was created in 1986 for the purpose of microbiological sanitation of dioxin contaminated soil. In the initial phase, universities and companies from Hamburg participated. The objective was to isolate microorganisms for decomposing persistent agents such as dioxin, furane, PCP, and polychlorinated biphenylene, as well as to develop technical processes for purifying waste water, seepage from waste dumps, and soil.

In the area of "Biotechnological Waste Treatment" for slaughterhouse decontamination, subsidies are available for cooperative projects at the slaughterhouse in Essen, at the cattle and meat center in Hamburg, and at the slaughterhouse in Hamm/Westfalen. The purpose is to obtain operational experience with different decontamination processes and with substrate-dependent problems during experimental tests. This topic was addressed at a workshop in September 1986 at the KFA [Nuclear Research Center] in Juelich, which is responsible for the project. The goal [of the workshop] was to discuss the state of this technology with representatives from industry, research, and the slaughterhouses, and to elaborate R&D perspectives for microbiology and hygiene, processing technology and substrates, utilization of gas, decontamination and economy, and the use of these processing technologies in developing countries.

## 2. Cell Culture Techniques

### 2.1 Topic: Substances Contained in Animal and Human Cells

Cell culture systems can be utilized both for problem definition in the area of basic research, and for bioproduction and/or product testing. The goal of ongoing research projects is to find new cell contents with interesting biological properties, to isolate them, separate them from mixed substances, test their operational spectrum, and to define their chemical structure. Particles and amalgamated cells will be used to manufacture substances like interleukines, for example Interferon, tumor-necrosis factor, growth factor, cytotoxic lymphokines, and monoclonal antibodies and vaccines. For these substances, not only is the quality of the product important, but also its efficiency.

Following the introduction of the Nobel prize-winning Hybridoma technology (Kohler and Milstein 1975) for manufacturing monoclonal antibodies, most antibodies continue to be produced in mice through the ascites liquid. Because mice in this case are used as extremely productive "bioreactors," it is a

challenge for modern biotechnology to replace the in-vivo system with in-vitro systems. This is also desirable from the perspective of eliminating animal experiments. Innovations in processing technology and biological systems are necessary. Relevant projects already have been subsidized.

Basic problems for the manufacture of reactors remain in the area of technical production aided by cell cultures. For example:

- minimal cell damage by the mechanical component (for example mixing and stirring systems);
- minimal cell damage and cytotoxicity by the biophysical component (oxygen supply, inhibiting metabolites);
- the requirement for continuous supervision of both the medium and the cell (biophysical parameters, vitality, and productivity of cells).

Industry and academia have worked together on these [problems] and they have been partially solved. However, at present there is neither an optimal nor a generally applicable system for mass culture.

The problem of mass culture of human monoclonal antibodies through in-vitro immunized and immortalized lymphocytes is the subject of a large scale industrial project in which two universities are participating. The various cell culture systems developed to date make it possible to identify the most suitable culture system for a given problem relatively quickly on a small scale with regard to cell line, product, and medium.

Monoclonal antibodies are mostly used in the area of diagnostics. In therapy, they are used at present only for tumors (for example, against the small cell lung carcinoma). To avoid the side effects of animal antibodies, such as anaphylactic shock, the research aims at producing antibody chimeras or antibodies of exclusively human origin.

Further efforts will attempt to attack certain substances to the antibodies, in order to have them transported to the target area. This would have the advantage that medication could be targeted, and side effects through cytotoxic substances could be reduced. In this connection, a cooperative project in which laboratory and clinical researchers collaborate on these problems is noteworthy.

Since the beginning of the 1980's one cooperative project--in which nine universities and one industrial company participate--has been concerned with the class of interleukines. Because interleukines are produced in extremely small quantities, genetic engineering methods were used in addition to conventional ones. However [the project] was not only concerned with production issues, but also with the development of detection methods for individual numerous interleukines and their specific activities. Questions on preparative enrichment of productive cells were also researched. In addition to the development of systems for mass cell cultures:

- a lymphokine which influences the proliferation and differentiation of B-cells (B-cell growth factor, BCGF II) was identified;

--a new inductor for interferon synthesis was found;  
--monoclonal antibodies against synthetic peptides--that is, peptides which describe partial sequences of molecules with specific biological functions--were produced successfully.

In November 1985, KFA Juelich's project department for biology, ecology, and energy organized a status seminar for cell culture technology. Papers given in this seminar were published by the BMFT in the "Animal Cell Cultures" publication.

In the area of cell fusion technology, electrofusion is the focal point of subsidies. Since 1983, two industry partners have cooperated on the project, "Electrofusion of Yeast Protoplasts for the Breeding of Technically Relevant Yeasts With New Properties," to develop new equipment and to conduct genetic engineering experiments on new strains of laboratory bred yeasts. To date the project has yielded the following results: the development of new fusion cells has led to quantifiable and enhanced fusion yields. During fusion of uniform or variable types of yeast, progress was made regarding the stability of the hybrids produced. A very important result for applications in the food industry was the production of a hybrid with enhanced pectinolytic enzyme activity (maceration of fruits and vegetables). The continuation of this project aims at further optimizing electrofusion by including physical and chemical parameters as well as the development of equipment for the new method of DNA electrotransfer. On the biological side, more attention will be paid to special problems related to production strains used in the food industry. For example, different strains of yeast can be fused to obtain hybrids which have the typical behavior of a production strain, but at the same time add the specific key enzyme of a strain which is otherwise not technically usable. These hybrid yeasts are needed in the food industry, where not only the main product of fermentation, but also its byproducts (such as aromatic substances) are of great importance for the final product.

## 2.2 Topic: Groundwork for the Application of Plant Cell Cultures

The area of plant cell and tissue cultures is being subsidized with a view toward basic research, but above all because of the potential for practical application, such as the production of cell contents for applications in medicines. In a BMFT status seminar held on 9 May 1985 at the KFA Juelich, the potential for utilizing plant cells and tissues in research and industry was discussed. The seminar papers were published in a booklet in early 1986. The discussion of future efforts in the area of plant cell and tissue cultures has continued following the status seminar with a number of scientists. This resulted in the BMFT announcements on 24 February 1986 regarding the subsidy of research and development projects in the area of "Plant Cell and Tissue Cultures".

## 3. Bioprocessing Enzyme Technologies

### 3.1. Topic: Development of New Bioreactor Systems

Subsidies in the area of bioprocessing technology are oriented toward topics proposed in the announcement for bioprocessing technology dated 27 November

1984. The results of basic research have been transformed into developments for processing technology and equipment systems in the areas of bioreactors, processing and reprocessing methods, as well as test and automatic control systems.

Many projects are part of the pre-production phase such as the research study, "Anaerobic Fermentation," in which companies from various sectors and several research institutions are participating. With new anaerobic thermophili production strains, waste products from the starch and food industry will be refined by fermentation to high grade raw chemical materials such as organic acids, alcohols, unsaturated compounds, and amino acids.

Another objective for industrial application is the fermentative production, analysis, and biopolymer reprocessing. These polymers can be used in technological areas such as oil drilling aids or in the food industry as additives. The fermentation process requires the provision of production strains, the development of adaptable fermentation and process control strategies, and the development of substance analysis as a complementary reprocessing method.

The following areas were at the center of the 1986 subsidies:

- new methods for reprocessing, separation, and refinement;
- production of valuable substances with carrier fixation methods (material research, adhesive processes, and production conditions required for fermentation);
- bioprocessing technology (new bioreactor systems such as fluid bed reactors, fixed bed reactors, airlift reactors).

These research projects were carried out as cooperative projects.

R&D requirements still exist in the following areas:

- technical testing of bioreactor systems, especially for animal and plant cell cultures;
- processes for the enrichment and purification of active agents and fermentation products;
- process control systems, analysis methods, and on-line test probes for data collection and processing.

Subsidy measures must therefore increasingly take these R&D gaps into account.

### 3.2 Topic: Measurement Techniques, Control Engineering, and Equipment Development

Most of the long term risky development and testing of equipment for biotechnology is done by technical universities in cooperation with industrial companies, from the laboratory to the semi-technical and technical level. Equipment development requires the personnel and financial capabilities which universities alone cannot provide. The following are examples of such cooperative projects:

- development and testing of modular peptide sequencing and analysis systems;
- development and testing of free flow electrophoresis systems for preparative, semi-technical separation and reprocessing of cells and biotechnically produced substances;
- development of fermentation systems for multiple use;
- development and testing of a mass spectrometer suitable for biotechnology, molecular biology, and genetic engineering.

The immobilization of micro-organisms has become increasingly important; for example, during the production of substances through fermentation and during waste water purification. Two cooperative projects are concerned with the material engineering questions of carrier substances, surface properties, and the specific surface modification for optimal adhesion of micro-organisms. Sintered glass will be used as a novel, regenerative carrier for a broad spectrum of applications. R&D gaps remain in the pre-industrial [vorindustriellen] R&D, in the areas of immobilization techniques, on-line process analysis, and technical reprocessing methods, among others.

### 3.3 Topic: Separation and Reprocessing Methods

In May 1986 KFA Juelich held a workshop on the subject of technical processes for the production of bio-alcohols with participants from industry and science. The objective of this workshop was to define the actual state of the art in bio-ethanol production and to elaborate R&D prospects for the BMFT in microbiology, the use of substrates, process technology, separation and purification methods, as well as the economic and ecological impacts.

Starting points for future research in the field of microbiology were identified as the improvement of yeast technology, further development of fluidization technology, and the expansion and enhancement of yeast and bacteria strains through genetic engineering. In process technology, prospects for future R&D are primarily found in the continuous and coupled processing method (coupled products), and in the further development of pervaporation technology [Pervaporationstechnik] in the separation process. There are research gaps for information on substrates in the areas of enzymatic and coupled hydrolysis, and in the breeding of cellulose-rich substrates. Waste management must be improved with regard to fluidization technology, utilization and purification of residual matter. In 1986 these starting points began to be addressed by individual research projects.

## 4. Research on Plants and Animals

Plant breeding activities in the FRG may be divided into the following three areas:

- breeding of useful agricultural plants,
- breeding of horticultural plants,
- breeding of silvicultural plants.

Most plant breeding activities to date and in the foreseeable future are associated with agriculture. This is reflected not only in the number of subsidized projects, but also in the biotechnological methods used (cell



culture technologies, molecular biology, cell fusion, genetic engineering, and so on). The use of these techniques in breeding horticultural or silvicultural plants is still in the initial phase.

A large part of the research on agricultural plants is coordinated through the Association for the Subsidy of Private German Agricultural Breeding, e.V. This is especially true for the cooperative projects "Development of Biotechnological Selection and Utilization Methods for Breeding of Cultivated Plants with Genetic Resistance and Quality" and "Employment of Cell Fusion Technology for Accelerated Breeding." These consist by and large of 43 partial projects at institutes of the Federal Biological Institute, the Agricultural Research Institute, universities, and Max Planck institutes on the subject of developing modern and efficient biotechnological breeding methods. After successful conclusion of these projects, it may be possible to achieve the goal of a targeted transfer of commercially important genes from, for example, a wild to a domesticated plant. The necessary prerequisite (for example, gene indices) are still lacking at present or have just begun [to be realized].

Subsidized research to date has been oriented primarily toward genetically establishing disease resistance which in the end is closely correlated with the quality of plant products. With corresponding agreements with industry, an arrangement for modification of desired content material appears possible because the basic technologies are available in principle. Through this research, which is carried out in various basic research institutes, a very high overall flexibility is available which allows new target areas to be incorporated relatively quickly. Furthermore, the technology transfer to member companies and the knowledge transfer among cooperating research institutes is considered to be very positive.

Also in the realm of agricultural cultivation are the activities at the University of Hohenheim for "Application of Molecular Genetic and Cell Biological Methods for Plant Breeding." The goal of this cooperative project, besides building appropriate research capacities, is to contribute to reducing environmental stress in agriculture, for example by resistance breeding.

Another cooperative project--between the Munich Technical University and the Federal Biology Institute--is concerned with the diagnosis of the commercially important barley gene, thereby creating the basis for targeted genetic modifications (for example, of the cell contents). This basis will then be used for the realization of established breeding goals.

In the area of horticulture, a cooperative project is currently being prepared for the "Development of Methods for In-Vitro Selection of Calcium Tolerant Rhododendrons" which will make a special contribution to the competitiveness of this industry and to environmental protection through reduced needs for peat. Responsibility for scientific implementation of this project lies with the Federal Research Institute for Horticultural Cultivation. The project is supported by a subsidy team of 26 horticultural companies to ensure that the project has practical relevance.

Forest cultivation is in its early stages compared to agriculture. A short time ago in-vitro culture and reproduction of aspens was successfully attempted. The cooperative project "In-Vitro Culture of Forest Trees" is underway. Its main concern is the safeguarding and in-vitro reproduction of valuable genotypes with the goal of utilizing them as carriers for the reproduction of important tree species, beech, oak, and pine. A few noble deciduous trees have been included in this research as well. Once this joint project has been successfully completed it will be capable of considerably increasing progress in cultivation, of safeguarding valuable genetic material, and possibly also of ensuring a continual supply for the species under scrutiny. In addition, biotechnological methods and processes will be introduced in the area of silvicultural breeding.

A cooperative project is being prepared on the "Biotechnological Production and Utilization of Industrial Wood" to formulate a method for in-vitro selection for disease resistance and in-vitro modification of poplars. Callus cultures of spruce and douglas pines are planned. In addition, there are plans to establish a methodology for defining DNA restriction fragment length polymorphisms (RFLP) in poplars for the detection of genetic variations in comparison with electrophoresis. These activities speed up silvicultural cultivation as well as the introduction of modern biotechnical processes in plant breeding; they are an essential part of the targeted goals for the production of industrial wood.

Other cooperative projects being prepared in the area of regenerated raw material and plant breeding are "Symbiotic Interaction Between Micro-organisms and Cultivated Plants," with the objective of heightening the symbiotic performance of micro-organisms thereby possibly increasing biomass production; and "Biotechnology for the Breeding of Oil Plants," using rape and cipeha as examples with the objective of understanding the bio-genesis of cell content and later to possibly influence it.

#### 4.1 Topic: Plant Cultivation and Regenerated Raw Materials

In the area of biomass production, an ongoing joint project on "Biomass Production of Fast Growing Species of Trees" is continuing among the Federal Institute of Forest and Wood in Hamburg, the Association for the Promotion of Fast Growing Tree Species e.V. in Hannoversch--Muenden, and the University of Munich. The primary goal of this project is to establish the necessary conditions for utilizing agricultural areas for biomass production. The resulting wood is tested to determine its suitability in the manufacture of particle boards and chemical pulp, and in energy production.

A program studying "Integral Utilization of Rape as a Fuel Substitute in Agriculture" is underway, financed through the existing program budget as well as by funds from the EC Commission in Brussels. A model farm will be used to demonstrate how the yield of approximately 40 hectares (400,000 square meters) of rape can be used for energy production. The entire production is refined at the farm: one half of the purified rape oil is used as fuel for a modified tractor and the other half is transformed into a diesel substitute which can be used in conventional tractors. The residue is used as animal fodder or

fertilizer. Rape stubbles are used as soil enhancers and in pellet form as solid fuel for household heating and general drying.

A series of projects have been carried out in the area of converting products made from regenerated raw materials for chemical use, in which raw materials with a sugar, starch, or oil/fat base are, through chemical or bio-engineering processes, transformed into products with a variety of uses. Developments for the production of ethanol and acetic acid are part of this area, as are biogas and high grade intermediate products for chemical reprocessing (derivates of fatty acids, biosynthesis of polysaccharides and so on).

An initiative in the area of conversion technology for regenerated raw materials is expected to revive basic research in the areas of sugar, fat, and polysaccharide chemistry. During the reporting period, proposals have been developed by working teams in which science and industry are proportionally represented. The projects are in the preparatory phase and are scheduled to start soon.

#### 4.2 Topic: Biological Plant Protection

The development of biological plant protection agents has been promoted with the goal of limiting the use of environmentally hazardous chemicals or making them partly unnecessary. Methods for the use of pheromones in biological plant protection have been successfully developed. A cooperative project with several partial applications on the theme "bacillus thuringiensis" is being subsidized for the development of processes for producing microbacterial metabolites. Finally a project is being subsidized for the process of isolating, mass producing, and utilizing insect-pathogen viruses in which research will be conducted to allow insect viruses to be used in outdoor cultivation. Most of the ongoing projects are concerned with plant and animal protective agents of great interest to biological plant protection.

The advisory board of the Federal Biological Institute has presented a "Memorandum on the Subsidy of Research on Biological Plant Protection" which was discussed in the first round of talks with the FRG's Ministry of Nutrition, Agriculture, and Forests. A preliminary version of the research program was drafted which should be in a final form by spring 1987, then jointly subsidized by the BMFT and the BML.

#### 4.3 Topic: Substitutes for Animal Experimentation

The "Substitutes for Animal Experimentation" announcement was published in the federal gazette in December 1984. This research program is based on the understanding that alternative methods cannot be ordered as simple "theoretical blueprints" for pharmacological practice, but can only be developed out of practical research tested with concrete problems. Accordingly, the requirements of applied research must remain in the forefront of methodological preparations and orientation of project goals in the corresponding research projects. There was a large response to this announcement and the SK team "Substitutes for Animal Experimentation" has met four times since the summer of 1985. Meanwhile, about 24 industrial projects were approved; most are cooperative efforts with universities.

The broad spectrum of subsidized topics was apparent at the BMFT status seminar at the Juelich Nuclear Research Institute in October 1986. A major portion of the projects deal with questions of toxicology, immunology, and tumor therapy. The utilization of cell cultures as in-vitro models is examined in the heart muscle cells, smooth muscle cells, nerve cells, liver cells, and cells of the mucous stomach lining, among others. In several projects computers and molecular modeling are used for screening in an effort to reduce the number of animal experiments. Furthermore, several projects have taken up certain individual themes of pharmacological research. For example, a large scale project at the University of Berlin has taken up the question of whether it is possible to find in-vitro models for the embryotoxic examination of substances. A new edition of the BMFT brochure "Substitutes for Animal Experimentation" has been published for the status seminar, containing reports on all ongoing projects. Six thousand copies of the brochure have been printed and distributed.

Accompanying ongoing research is a study by the Batelle Institute with the objective of discovering, with emphasis on pharmacology, the types of animal experiments used in practice, and the scientific questions that are associated with them. The results of this poll should provide indications whether BMFT targeted projects can be activated to clearly and efficiently reduce the number of experimental animals used. Future research should include projects for comparing and evaluating various test models, joint testing with industry, and the creation of models for computer aided simulation.

#### 4.4 Topic: Safety Research

Under the heading "biological safety," a workshop on the subject, "Release of Genetically Modified Organisms--Safety Aspects" took place on 17 January 1986 at the University of Hamburg's Institute for General Botany summarizing the present status of research in these areas. Several research projects were subsequently initiated. In part, the research had begun earlier, for example, regarding questions of risk evaluation during the transfer of artificial herbicide resistance in useful plants.

### B. Subsidies for Genetic Engineering and Central Projects

#### 1. The "Industrial and University Research" Survey

The FRG's Central Commission for Biological Safety (ZKBS) registered 1,271 genetic engineering projects from 1978 to June 1986. A breakdown of the experiments by institute can be found in table 1.

The overall expenditures of German industry on genetic engineering research are in the area of DM200 million per year. The cooperation among industry and universities, the MPG, the FhG, and large scale research institutions has intensified over the last few years.

In addition to 34 universities and 10 Max Planck institutes, the following large scale research institutions have work teams on genetic engineering:

--the German Cancer Research Center, Heidelberg;

--the Society for Biological Research, Braunschweig.

To a lesser extent, genetic engineering methods are also used in the biomedical research institutes of the following large-scale research facilities:

--the Society for Radiation and Environmental Research, Neuherberg;  
--the Nuclear Research Center, Karlsruhe;  
--the Nuclear Research Institution, Juelich.

## 2. BMFT Subsidy Measures

### 2.1 Subsidy of Theme-specific Cooperative Research and Projects

The direct subsidy of research projects in genetic engineering (1986 research budget: DM10.3 million) in universities, industry and public research institutions concentrates on establishing methods for new combinations of genes and on using them for special problem solutions. The number of directly subsidized projects appears to be increasing; on 30 May 1986, 36 ongoing cooperative research projects were counted.

Among others, subsidized topics are concentrated on the cloning of certain lymphokines; the treatment of influenza as well as human and animal pathogenic herpes viruses; the production of vaccines against the AIDS virus and against parasitic diseases like malaria; the improvement of protein quality in corn; on questions of biological plant protection, for example, bacillus thuringiensis toxins; on nitrogen fixation; and on risk evaluation of artificially produced herbicide resistance in useful plants.

Table 2 shows the various projects, divided by topic, number of projects, and amount of subsidy as follows (without institutional subsidies and genetic engineering research centers).

### 2.2 Subsidy of Central Projects ("Genetic Engineering Research Centers")

Since 1982-83, the goal of research efforts by molecular biology and biomedical work teams on central projects, first in Heidelberg and Munich, then in Berlin and Hamburg, has been to develop scientifically attractive and technologically promising research areas in biotechnology.

The concentration of subsidies in centers where universities, industry and scientific organizations have come together in a joint effort for bio- and genetic engineering research, provides new impetus for basic research in biomedicine and for a concentrated subsidy of junior scientific staff.

In 1986, there were over 300 junior staffers at the three genetic engineering centers in Cologne, Heidelberg, and Munich alone, mostly candidates for bachelor and doctoral degrees.

The expansion phase at these centers has reached a total of approximately DM18 million. Industry contributes about DM3 million per year in addition to the various contributions of the concerned land governments.

## 2.2.1 Financing Models and Financing Volume

In principle, the financing of genetic engineering rests on 3 pillars:

- a) initial start-up with funds from industry (salaries for top personnel, infrastructure measures, etc.);
- b) investments for building activities on the part of the federal states, or infrastructure funding from the universities or MPG [Max Planck Society], and the federal states;
- c) project subsidies from the BMFT (personnel, property, equipment) and other third party contributors (DFG-SFB).

Genetic Engineering Center, Cologne

Max Planck Institute for Breeding Research (10 subprojects)

University Institute for Genetics (6 subprojects)

Industrial participation: Bayer AG, DM1 million per year; BMFT project subsidy: DM21.8 million for the years 1982 to 1986, of which half goes to the [competent] university institute;

A grant is issued to the MPI [Max Planck Institute], and the funds for the university project are handed over to the university as a subcontract. The federal land NRW [North Rhine Westphalia] is building a laboratory for junior staff on the MPI grounds for DM10 million. After completion in 1988, financing for junior staff members will be available for 10 years within the framework of the BMFT project subsidy. Industry must supply the basic financing.

Genetic Engineering Center, Heidelberg

Center for Molecular Biology, Heidelberg (9 junior staff team, 9 work teams)

Status: university center; industrial participation: BASF, DM1 million per year (University-BASF agreement); participation of the lands: DM15 million for building projects after HBFG financing of the infrastructure (30 places, running costs); BMFT project subsidy: DM46.4 million for the years 1982-1989; Other third party funding: DFG special research area (approximately DM3.5 million per year), approximately 75 percent of the funding for personnel and property is being paid by third parties.

Genetic Engineering Center, Munich

University of Munich (6 junior staff teams, 5 work teams)

Max Planck Institute for Biochemistry (3 junior staff teams, 2 work teams)

Industry participation: Hoechst AG, DM1 million per year, Wacker Chemie, DM0.2 million per year (agreement with the subsidy association); participation of the lands: 2 infrastructure positions, a further 15 positions are planned;

BMFT project subsidy: University of Munich DM18 million for 1984-1987, MPI DM9.1 million for 1984-1987.

The genetic engineering center is co-located with the 9 junior staff teams in the MPI. A new building is currently under discussion.

"Center for Molecular Biology," Hamburg

The subprojects "molecular neurobiology" and "applied molecular biology of plants," (8--later 10--junior staff teams, 7 work teams, 3 project teams)

Status: a specialized supervisory center within the University of Hamburg with participation of the Botanical Institute, the Institute for Cell Biochemistry and Clinical Neurobiology, and the university hospital in Eppendorf; industrial participation: not yet defined; participation of the lands (preliminary budget): DM2.8 million per year for personnel costs; BMFT project subsidy (survey not yet completed) DM14.7 million for one-time expenditures on equipment, DM2.6 million per year for running costs, and DM6.6 million per year for personnel.

Genetic Engineering Center, Berlin

Institute for Genetic Biological Research

Status: Corporation, of which the shareholders are the Land of Berlin, and Schering AG, Berlin, and Bergkamen; capital stock: DM50,000, with a preliminary validity of 10 years; land/industrial participation: one half by the Land of Berlin and Schering AG, DM2.2 million per year for personnel costs, DM1.9 million per year for equipment costs, DM5.5 million per year for investments (figures for 1986), and DM18.4 million for building costs, financed one-half each by the state of Berlin and Schering, and by ERP loans; BMFT project subsidy: 6 work teams for 5 years for the time being, costing approximately DM3-4 million per year.

## 2.2.2 Examples of Research Activities at Genetic Engineering Centers

Studies of plant molecular and cell biology at the genetic engineering center in Cologne demonstrate the multiplicity of contributions genetic engineering technology can make to progress in plant cultivation, as for example in the goal of breeding cultivated plants for disease resistance or salt tolerance.

From in-vitro cultures (cell cultures) of cultivated plants that are particularly important for the application of genetic engineering methods (wheat, corn, rice, barley, rye), the scientists at the Cologne genetic engineering center succeeded in regenerating plants of all important cereal species in any quantity. Two new methods were successfully developed for direct gene transmission in cereals. This permits an astonishingly short transformation to take place, that is, the direct transmission of foreign genes into the desired plant cell. The several decades required for successful breeding can thus be reduced to a few years. Finally, the Cologne scientists have developed the "cauliflower mosaic virus" as a test system for the production of virus-resistant plants. The research for clarifying the

molecular basis for potato resistance to a fungus which causes the dreaded cabbage and potato rot promises to be successful and extremely important in practice.

Of special interest at the genetic engineering center in Heidelberg are the molecular interactions and signal transmission mechanisms between the cells of an organ or an organism.

In the "Center for Molecular Biology, Heidelberg" (ZMBH) scientists research the so-called neurotransmitter receptors and are concerned with clarifying the function of "receiver molecules" in the membranes of nerve cells.

Knowledge of signal transmission mechanisms between nerve cells is considered to be the key to understanding cramp conditions and paralysis at the molecular level. Advances in knowledge will be the decisive factor for a successful development of therapy, for example neuro-pharmaceuticals.

Among the large number of interesting research prospects at the ZMBH, the successful fight against the hepatitis-B virus is of worldwide interest. Together with the results of other work teams, the scientists in Heidelberg succeeded in creating the prerequisites for a vaccine that can be produced by genetic engineering. The vaccine will probably by the first of its kind capable of being used on a large scale thereby clearing the way for a worldwide fight against hepatitis-B.

At the genetic engineering center in Munich, scientists research questions of immunology at the molecular level; in this case, however, to clarify the structure of human antibodies. Certain constellations of these antibody genes are considered a risk factor for particular rheumatic diseases.

Of great practical interest is the Munich genetic engineering center's research on the production of proteins such as hormones in bacteria and yeast through genetic engineering. A fascinating research goal is the clarification of how a human gene can be correctly translated in yeast cells and then transferred to a protein. The importance of these results for medicine is obvious.

At the genetic engineering center in Berlin the following themes will be researched:

- molecular biological research of higher plants breeding (improvements in cultivated plants; for example, increasing the albumine content of potatoes, resistance against nematodes);
- molecular biological research on micro-organisms which interact with higher plants (parasite/host plant).

At the Hamburg Center for Molecular Biology, research projects will be conducted in the areas of "molecular neurobiology" and "applied molecular biology of plants."

The research program is only a concept at present. The primary emphasis will be on researching molecular activities in the nerve system. Through genetic



engineering, important substances that are present in the nervous system only in minute quantities will be produced in such quantities so that their biomedical functions can be investigated. In the area of plant molecular biology, genetic engineering methods will be used, among other things, to improve the pest resistance of useful plants and their tolerance of low temperatures and, through the improved utilization of nutrients, to reduce environmental stress by agro-chemicals.

## 2.3 Subsidizing Junior Scientists

In addition to the genetic engineering centers, the following instruments for the subsidy of junior staff must be mentioned:

- "research grants for biotechnology" through the German Society for Chemical Equipment (DECHEMA);
- grant program for genetic engineering in cooperation with the German Academic Exchange Service (DAAD);
- co-financing of a "biochemistry" fund of the Chemical Industry Association (VCI) for the subsidy of junior scientists.

The junior staff subsidy "research grants for biotechnology," run by the DECHEMA in Frankfurt, is the most recent measure by the BMFT and has been in effect since January 1986. DECHEMA reports that in the few months since the start of the subsidies 60 scholarships have already been granted.

Besides the scholarship programs at home, scholarships are also granted abroad in cooperation with the DAAD, particularly in the areas of genetic engineering and cell biology.

The special genetic engineering program was started in 1983 and to date has yielded 289 scholarships. A much higher demand for scholarships has been observed over the past 2 years. In 1986 alone, 92 scholarships were granted by the DECHEMA.

BMFT measures for subsidizing junior staff in biotechnology are supplemented by BMFT participation in the VCI's "fund for biochemistry." Highly talented scientists are subsidized by grants for training, material, and equipment, especially at universities and other public institutions.

## C. Indirect Measures

### 1. Indirect, Specific Measures for Subsidizing Biotechnology Industry

#### 1.1 Subsidy Concept

A part of the biotechnology program, which is primarily dedicated to subsidizing the biotechnology industry, is based on indirect-specific subsidies for product development through cell culture and genetic engineering methods, and on development of biotechnology processes including development of equipment and devices. This subsidy is aimed at strengthening the R&D capacity of mid-level companies regarding required new technologies.

Approximately DM100 million has been allocated for indirect-specific subsidies of the biotechnology industry for a preliminary 4-year subsidy term (1986-1989). The program began in April 1986.

This indirect-specific measure concentrates on broad subsidies of product development by means of cell culture and genetic engineering methods and the development of biotechnological processes, including development of equipment and devices. This is connected in particular with increased subsidies for strengthening R&D capacity in mid-level companies regarding required new technologies.

The essential characteristics of indirect-specific subsidy measures are:

- no state influence on the contents of individual projects (indirect aspect);
- subsidy of all R&D work in certain main areas of effort in biotechnology;
- no obligation to publish research results;
- the subsidy recipient has exclusive rights to use [the research];
- a clear reduction in the effort required for application, approval, expense reporting, and documentation of use.

The measure is limited at present to the period 1986 to 1989.

Subsidies are available for:

- the development of products and intermediate products by means of cell culture and genetic engineering methods;
- the development of biotechnological processes
  - a) with plant, animal, and human cells
  - b) with genetically modified and industrially significant micro-organisms
  - c) for biological plant protection and plant cultivation on a basis of genetic engineering;
- the development of enzyme technology processes for medical, nutritional, and other industrial applications;
- the development of equipment and devices for manufacture of final and intermediate products by means of cell culture and genetic engineering.
- the development of bio-reactors, including integrated test and control technology for biotechnical processes with cells and micro-organisms, enzyme technology processes for nutrition and other industrial applications.

In a phase preceding the actual development stage, preliminary research, alternative investigations and feasibility studies are subsidized. The subsidy period in the preliminary phase is limited to 6 months and is assumed to be necessary for those companies that are using biotechnological methods for the first time.

The development phase begins when a concept is formulated after the completion of preliminary work (either performed at [the companies'] own expense, or subsidized in the preliminary phase).

Subsidies are available for the development of products, processes, and equipment for a company's own use and the purchase of necessary larger equipment, machines and installations; R&D contracts with companies or

institutes specializing in technology; and for necessary third party technological consulting.

The maximum subsidy per company during the term of this indirect-specific subsidy is a total of DM600,000 out of which up to DM50,000 is available for the preliminary phase. Funds for additional developments can be granted up to this maximum level.

The non-repayable subsidy amounts to 40 percent for personnel costs, orders for third parties, and consultancy costs such as:

--a lump sum for personnel costs per man-month

- \* for qualified scientific and technical personnel (for example, biologists, chemists, engineers,) DM12,000

- \* for laboratory personnel (for example, technicians, technical assistants, specialized labor,) DM7,000

The cost of other personnel cannot be considered. The lump sum covers primary and secondary personnel costs, common expenses, the cost of auxiliary personnel, as well as expenses for travel, materials, and special training courses;

--one-time costs for third party R&D contracts;

--one-time costs for technological consultancy by third parties;

--and 25 percent for investment costs such as one-time expenditures for new equipment on the market, devices, and installations.

Subsidies for the cost of third party contracts and technological consulting are limited to an amount of subsidy equal to the cost of [a company's] regularly employed personnel. Subsidies for the cost of equipment, devices, and installations are limited to 25 percent of the total subsidy during the development phase.

Legally independent companies with headquarters and businesses located in the FRG and West Berlin are entitled to subsidy, provided they

--have previously worked in the area of biotechnology and want to use biotechnological methods in the future, or

--do not at present work in the area of biotechnology, but have the basic prerequisites to produce or develop useful equipment or processes through the adoption or application of new biotechnological methods.

Holding companies with 50 percent or more shares are considered a company with regards to the maximum subsidy level and the preliminary phase.

During the application for the development phase subsidy, the applying company must provide evidence that it possesses equipment and devices capable of developing biotechnological products and processes and of manufacturing the essential stages on their own premises.

## 1.2 Balance for 1986:

By the end of 1986, 47 companies made a total of 54 applications for subsidy of R&D projects. Up to that point, 38 grants totalling about DM11.3 million were given, which will activate a further DM20 million of the company's own money for R&D projects. Eleven companies which were newly concerned with biotechnological research received subsidies for feasibility studies in the preliminary phase. Twenty-seven projects in the actual development phase were subsidized with amounts up to the maximum of DM600,000. Subsidies for developing biotechnical products, processes, and equipment within each company [fall in this category].

Sixteen projects with orders of approximately DM5.2 million were in preparation as of 31 December 1986, and the grants are expected by the first quarter of 1987.

In 1986, five preliminary phases were completed. Two projects were directly connected with the development phases; for the others, the continuation of the R&D project can be expected in development phase.

An initial overview of the applications granted or in processing shows that approximately 90 percent of applications are made by small and medium size companies.

83.3 percent of subsidized companies have fewer than 500 employees. They receive DM9.9 million, that is, about 87 percent of the funds granted.

The distribution according to main subject areas shows heavy use of the program by equipment and device manufacturers which are carrying out development work for reactors, for product processing and reprocessing, and for the biochemical laboratory practice. Another major effort is the subsidy of small and medium companies concerned with developing biotechnological processes with cells and micro-organisms of importance to industry. Among other things, this subsidizes the efforts of companies working in the area of plant cultivation to develop products based on methods of cell culture engineering to complement or replace conventional cultivation methods. This also means subsidizing biotechnological process developments with industrially important micro-organisms, for example, in the area of waste water microbiology.

In addition, subsidies are available within the framework of the program for enzyme technology projects, and final or intermediate product development, as the case may be, by means of cell culture engineering.

In summary, it can be said that in its 9 months of existence the specific indirect subsidy program has been very well received by the biotechnological industry, especially by small and medium companies, and that there is strong interest in the subsidy measure. The program provides decisive impetus for companies to exploit the possibilities that lie in the use of biotechnology.

## 2. Subsidies for Establishing Technology-oriented Companies (TOU)

Since mid-1983, the FRG's minister for research and technology has carried out the experiment, "subsidies for establishing technology oriented companies (TOU)," as a way of using the invigorating element of young technology oriented companies to accelerate the development of innovative technologies.

These subsidy activities have primarily contributed to the creation of a climate open to innovations as well as to better start up and growth conditions for technology oriented companies. Particularly in the area of promising future technologies, new companies are being actively established and subsidized. Cooperation between technology advisory offices and investors has made more venture capital available for this type of company foundation.

Internationally, biotechnology has become particularly significant in research and technology policy. It enjoys a key position because of its high potential for innovation in the development of large areas of our national economy. This led the federal minister of research and technology to extend the TOU experiment to biotechnology.

In the beginning of 1985 a project management for biology, ecology, and energy (PBE) was created at the KFA in Juelich on the federal level as a technology counseling office for the TOU experiment in biotechnology.

### 2.1 Concept and Subsidy Areas

The basis for this indirect subsidy measure is the program "Applied Biology and Biotechnology of the Federal Government 1985-1988." The following subcategories of innovative projects are being subsidized:

- cell culture technology;
- genetic engineering;
- bio-reactor development including test and control technology for biotechnological processes with plant, animal, and human cells, genetically engineered micro-organisms, as well as for enzyme engineering processes for applications in medicine and nutrition.

Besides falling into the above mentioned subcategories of biotechnology, other conditions must be met. Applications may be made by:

- persons who intend to establish a technologically oriented commercial company, or
- technology-oriented commercial companies that are not older than 3 years, do not have more than 10 employees, and are not majority owned by third parties.

Entrepreneurs or young companies normally take their ideas directly to the PBE. Depending on the status of the project, the following subsidy measures may be considered:

#### Phase 1

Subsidy for work toward drawing up the final documents, up to 75 percent of subsidizable expenses up to a maximum of DM54,000, for example market and patent research, etc.

#### Phase 2

Subsidies for financing innovative projects (R&D projects). The subsidy can be up to 75 percent of eligible expenses, but in principle not more than DM900,000. Bank loans necessary for financing these projects can be secured up to 50 percent, however with a DM150,000 maximum, by individual participation.

#### Phase 3

Bank loans necessary for financing manufacturing equipment and market introduction can be secured up to 80 percent, but with a DM1.6 million maximum for individual participation. Besides administrative project management, the PBE provides a considerable amount of intensive counseling for applicants and subsidy recipients. Counseling on business administration as well as science and technological is available during the preliminary talks. The counseling includes not only an assesment of a company's scientific, technological, and business administration program, but also analyzes the potential of a new invention or development. As a result of the intensive preliminary talks a recommendation is given either to establish a company or to abandon the idea.

#### D. International Activities

##### 1. Cooperation with Industrialized Countries

The goal of cooperation is the reciprocal use of the scientific and technological know-how available in appropriate partner countries to develop biotechnological processes or products in cooperative projects, saving time and money. Among other things, this includes the exchange of scientists, not only for the transmission of specialized knowledge, but also to repatriate the methods and techniques obtained in the host country.

Examples are:

##### Sweden:

Two projects were initiated for developing anti-viral therapeutics on the basis of nucleotides at a German-Swedish symposium on nucleotide chemistry. In addition, a project in the area of mammalian cell cultures was also started.

##### France:

A concept for broadly structured German-French biotechnology cooperation has been elaborated stemming from an initiative of the German-French society AFSAST. For the time being, four BMFT projects on genetic engineering have been approved for the development of new commercial vector systems.

## Japan:

In 1986, a list of proposals for five cooperative projects was discussed and approved on the occasion of the tenth German-Japanese science agreement. Several projects with Japanese partners have started.

## Britain:

The BMFT renewed its efforts to bring German and British laboratories and industrial companies together on the occasion of the German-British consultations in London in the spring of 1986. In the meantime, a project in the area of ring closure enzymes has been carried out. In addition, contacts have been pursued in the area of structural research on proteins with the objective of a bilateral protein design project.

## Canada:

German contacts have been intensified with the National Research Council in Ottawa and with selected laboratories. At the Canadians' request, discussions were held on expanding existing informal cooperation in the area of crop improvement, plant cell cultures, and environmental biology technology to the areas of animal cell cultures, vaccine development, bioelectronics, and protein design. Three project proposals for future cooperation are pending.

## 2. Cooperation with Emerging and Third World Countries

This in part serves for the transmission of advanced biotechnological processes and methods to these countries, with the objective of not only providing scientific assistance, but also of opening new markets for scientific, technological, and industrial installation in biotechnology. At the same time there are possibilities for using the raw materials which are available in these countries in a biologically processed form.

Of particular note in this context are Indonesia, Egypt, India, China, and Brazil. Measures for the training and advanced studies of guest scientists participating in bilateral cooperation projects are prerequisites for cooperative work in the following main areas of effort:

Biotechnological work for purifying and decontaminating the environment, work for diagnosis and therapy of special tropical diseases of animals and humans, and work on optimizing agricultural production and its associated nutritional technology. Some projects have already been awarded or are in preparation. The project sponsor has elaborated a list of proposals for about 20 cooperative projects for German-Indian cooperation on a workshop in Tuebingen which in part he organized on his own.

The objectives of cooperation with developing countries is seen in the fact that the transfer of simple biotechnological processes can contribute to the commercial development of the partner.

Within the framework of the BMFT program, "New Technology for the Third World," a detailed biotechnology concept is currently being elaborated with the help of the "Working Group on Tropical and Subtropical Agricultural Research."

Table 1: Distribution of Research Projects in the FRG (June 1986)

	Installations	Genetic Engineering Projects
Universities	38	697
MPG Institutes	15	200
GFE (DKFZ, GBF, KFK, KFA, GSF)	5	128
Industrial Companies	18	135
Others (Federal Institutions FhG, EMBL, DPZ, etc.)	9	111

Table 2: Distribution of Projects Subsidized by the BMFT within the Biotechnology Program by Topic (Direct Project Subsidies as of June 1986)

Topic	Number of Ongoing Projects	Budget in million DM
Agriculture	9	0.932
Medicine, pharmaceuticals	16	6.202
Energy, raw materials	3	2.012
Environmental protection	1	0.125
Safety matters	4	0.561
Others	3	0.392

Table 3: Status of Applications by December 31, 1986

Project	Number	Distribution of subsidies (in DM1,000)				
		Total	1986	1987	1988	1989
1. Pending Applications	16	5,171.5	-	2,007.2	1,932.2	1,232.3
2. Projects Granted (5 completed)	38	11,294.5	460.1	5,159.9	3,696.3	1,978.2
Total	54	16,466.0	460.1	7,166.9	5,628.5	3,210.5



Table 4: Companies and Subsidy Levels

Company	Percentage of Applicant's Participation	Share of Subsidies	Average Subsidy
Large Companies (over DM200 million sales per year)	7.4%	11.8%	DM490,000
Small and medium	92.6%	88.2%	DM290,000

8617

CSO: 3698/M315

## BRIEFS

FRAUNHOFER-UNIVERSITY BIOTECHNOLOGY PROJECT -- The University of Stuttgart and the Fraunhofer Society (FhG) have signed a cooperation agreement for a joint central project on biotechnology. The participants are: the Fraunhofer Institute for Surfactant and Biotechnology, and 16 institutes from three faculties of the University of Stuttgart. The central research topic is an integrated biotechnology process, including the preparation of biological systems and media, bioreactions, and product reprocessing. Biotechnology utilizes the whole spectrum of "classical" processing technology for the technical conversion of biological processes. The three project areas of biological systems, processing technology, and information technology require strong interdisciplinary cooperation among biologists, chemists, and processing engineers. By 1992 the Baden-Wuerttemberg Land will invest approximately DM70 million in appropriate buildings and laboratory equipment for the University of Stuttgart, and will create 60 new posts for scientists and engineers. In addition, four new institutes will be created for microbiology, industrial genetics, technical biochemistry, and biotechnology. While the universities are involved with matters relating to basic structure and training, the FhG will be more concerned with applied research and translating results into practice. The Fraunhofer Institute in Stuttgart has 35 scientists at present and will be expanded by 30 more positions. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457, 12 Jun 87 p 11] 8617

CSO: 3698/M325

## BMFT ANNOUNCES SUBSIDIES FOR EUREKA SOFTWARE FACTORY

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457, 12 Jun 87 p 6

[BMFT "Announcement of Subsidies for a Research and Development Project in the Area of Information Processing," dated 12 May 1987]

[Text]

I

The FRG's Ministry for Research and Technology [BMFT] intends to subsidize the EUREKA information processing project, "EUREKA SOFTWARE FACTORY."

EUREKA came to life during a conference of ministers from 17 countries and members of the EC commission in Paris on 17 July 1985. The goal of EUREKA is to enhance the productivity and competitiveness of European industries and economies on the world market.

On the basis of a declaration of principle adopted on 6 November 1985 in Hannover, several European companies and institutions defined the "Eureka Software Factory" (ESF) project. The project was announced in London on 30 June 1986 on the occasion of the third EUREKA conference and thereby obtained EUREKA project status (EU43). The definition phase of the project began on 1 September 1986 and will end on 31 August 1987. The main phase is scheduled to begin on 1 September 1987.

II

The goal of the project is the formulation and realization of a European software production environment that will help to satisfy the growing demand for software systems through a rational, engineered, and largely automated production process.

Methods and tools must be developed for this purpose, including new technologies that will make integrated methods and tool systems available on the basis of common carrier systems through adaptable, standardized interfaces for the various classes of software application.

An important area of effort is recycling prefabricated, user oriented components, capable of being combined with newly developed components to form

new software systems through suitable retrieval mechanisms and program transformation techniques.

The participating companies and institutions have projected a term of approximately 10 years for the overall project. However, the goal is to present the first useful results after about 4 years in order to underline the industrial nature of the project.

During the current 1-year definition phase, the principle requirements, architecture, and first interface concepts of the "software factory" will be established.

### III

According to the letter and spirit of EUREKA, companies and institutions considering cooperation during the main phase of the "EUREKA Software Factory" will be given the opportunity to obtain information on the project. This will be done during a workshop in Frankfurt on 1 July 1987 involving the European partners participating in the definition phase. Companies and institutions with considerable involvement in the area of software technology will have the opportunity to obtain an overview of:

- project partners,
- project organization,
- technical and strategic project goals,
- ESF system architecture,
- status of the definition phase, and
- future opportunities for participation.

Invitations for the workshop and information on the organizational agenda are available by request from the

ESF Conference Office  
Nixdorf Computer AG  
Frau Kerschbaumer  
Berliner Strasse 96  
8000 Munich 40  
Telephone 08936 01-28 71  
Telex 89 760 287  
Telefax 089/36 01-11 05

### IV

A requirement for subsidy is common planning and cooperation among the various partners in the R&D work according to the principles of the EUREKA constitution, and on the basis of results obtained during the definition phase.

The subsidy is governed by the applicable administrative principles of the BMFT. A legal claim for subsidy does not exist. Funds will be paid according to the available budget.

Shares in the amount of 60 percent of the costs are usually requested for applications by commercial companies.

Bonn, 12 May 1987  
413-5839-ITS 8601

On behalf of the federal minister for research technology,

Thomas

8617  
CSO: 3698/M323

## BRIEFS

DORNIER LEADS HYDROGEN PROJECT -- The Daimler Benz, Stuttgart; Dornier, Friedrichshafen; Lurgi, Frankfurt; and Badenwerk, Karlsruhe companies have agreed to continue development of the energy-saving "Hot Elly process" for the production of hydrogen under the management of Dornier. Dornier has been involved for a long time in the development of progressive energy systems and began more than 10 years ago, together with Lurgi, to develop a process for the production of hydrogen by means of electrolytic separation of water vapor with a high level of efficiency. As Daimler Benz declared in a press statement, a 5-year program is planned to solve problems with regard to long term behavior and large-scale production technology. Approximately DM30 million will be made available for this project. The German Federal Ministry for Research and Technology (BMFT) will participate in the financing of the project. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457, 12 Jun 87 p 8] 8707

CSO: 3698/M322

## SCHLUMBERGER AUTOMATIC TEST EQUIPMENT DEVELOPMENT, MARKETING PROFILED

Milan ELETTRONICA OGGI in Italian No 43, Jun 87 pp 87-92

[Interview with Fred Santamaria, manager for external relations for the test equipment division of the Schlumberger Group, and Bertrand de Courey, general manager for southern Europe of Factron Schlumberger, by Pierantonio Palerma: "Designing and Producing ATE (Automatic Test Equipment) in Europe;" date not given]

[Excerpt] ELETTRONICA OGGI: To start with, I would like you to outline briefly the Schlumberger Group's main activities and the reasons why companies like Factron and Sentry (working in the advanced electronics field), form part of a conglomerate which specializes in oil wells.

SCHLUMBERGER SISTEMI: As you said, Schlumberger originally was a group working in oil-related activities. At a certain point, the company decided to diversify its activities, and today we operate in four different sectors. The most well-known one is, of course, the oil sector. We also are active in the measurement and calibration field, what we refer to as "electricity management" and, together with Fairchild, are active in semiconductors. Finally, there is a group (called Computer Aided Systems, CAS) which includes the companies Applicon and Benson (operating in the fields of CAD/CAE/CAM [Computer Aided Design/Computer Aided Engineering/Computer Aided Manufacturing]), and Sentry and Factron, (producing ATE-type systems). Sentry and Factron also can be considered as two divisions of a single operating unit which, for the sake of simplicity, I will call "Schlumberger Test." Both divisions carry out test and inspection activity, Sentry in the semiconductor field and Factron in the field of plug-in cards. The two divisions have a complementary customer approach which exploits all the synergies which obviously result from working in similar environments and with customers with sufficiently similar requirements.

Also, we recently coined the name Schlumberger Sistemi to identify the areas of activity managed by the group I described earlier, Computer Aided Systems (CAS). Here again, the reason for this was to optimize the management of resources and companies operating in sectors which often overlap and require a global approach to markets and customer problems. I would like to emphasize that Schlumberger is giving new impetus to its activities in this field,

thereby contradicting in deed (as well as in word) the company's alleged intention of selling some of the CAS Group companies to third parties.

ELETTRONICA OGGI: We have described briefly the organizational structure within which Factron operates. Could you now give us a general outline of the strategy you intend to implement in Europe and in particular in Italy?

SCHLUMBERGER SISTEMI: I would like to talk about the strategies planned for both Sentry and Factron. In 1982 we had a payroll of 360, today it is 630. In the same year we invested \$2.7 million in research and development in Europe. Today our R&D investments total \$7.5 million. Our 1982 sales totaled \$30 million, and in 1986 we reached \$65 million. World test equipment sales for the Schlumberger Group total \$230 million. This makes us the leading ATE producer. About 6 months ago, Factron decided to create so-called "regions" in Europe. Previously, each country was considered as an individual entity; today we have Northern Europe (Great Britain, Scandinavia, and the Benelux countries), Central Europe (Germany, Austria, Switzerland, and the East European countries, excluding the Soviet Union), and Southern Europe. Although the latter region comprises all the Mediterranean countries, the greater part of this region's sales come from two major countries, France and Italy. Schlumberger's test equipment sales are divided almost equally between Factron and Sentry. Obviously, the situation varies from country to country. For example, we are particularly satisfied with our penetration of the Italian market, where we estimate our share to be 85 percent thanks to our distributor dB Electronic Instruments. We have recently reorganized our structure in this country, and have selected dB Electronic Instruments as our partner (for operations only, obviously not in financial terms), and this company therefore is our exclusive representative in Italy. Of course, Sentry and Factron are able to supply directly all the technical support, software and hardware required by customers. In other words, there is a direct Factron Schlumberger organization in Italy which has full control of its services and support activities but is not involved in the commercial side of the business, for which the distributor has sole responsibility.

ELETTRONICA OGGI: In Italy, as in the rest of the world, the competition is fierce. The competitors are companies which in some cases have been present in the country for much longer than you. What is your strategy with regard to these competitors?

SCHLUMBERGER SISTEMI: GenRad, Teradyn, and others are names we come across frequently throughout the world. The situation in Italy is fairly similar to the French one. In these countries there are local manufacturers (Spea and Olivetti Tecnost), while this is not the case in Germany and Britain. Our strategy is the classic one. First, we have to gain sufficient penetration with those customers we consider "key customers," (80 percent of our sales are generated by 20 percent of the electronics industry). We have a lot of key customers in Italy, for example, Olivetti, Italtel, and Aeritalia. For us, to reach sufficient sales levels with these customers involves two major problems. The first is the fact that, for historical reasons, these companies already buy from our competitors. Also, their products are technologically more advanced and often exploit to the maximum the capabilities offered by the most sophisticated silicon production techniques. Therefore, these are



companies which are looking for a partner to solve their production problems, not simply an ATE salesperson. Factron's strategy is not to sell test equipment. We sell solutions. And these are not just words. We are the only company in the world with an organization which enables us to adapt our machines to the specific requirements of each customer. We have groups of technical personnel both in the United States and in Europe who are able to solve the user's problem by offering a complete solution rather than just a special product. Therefore, Factron's strategy and strength are constituted by its ability to customize both the product and the solution, adapting itself fully to customer requirements.

ELETTRONICA OGGI: How can you implement this strategy in a country like Italy where you are using a distributor which, one would imagine, does not have the same level of technological know-how in ATE as you?

SCHLUMBERGER SISTEMI: As I mentioned before, the distributor only deals with the commercial side of the business. He knocks at the customer's door, conducts negotiations, and deals with the financial aspects. We are the ones who, through our direct organization in Italy, guarantee the "technological contents" of the sale. When Factron and Sentry decided to work through a distributor they did not intend to leave him either the honor or the full burden of carrying the Schlumberger flag. The strategy was to establish a contract with a reputable and well-known distributor, guaranteeing him complete technical support.

ELETTRONICA OGGI: In Italy, there are ATE companies which apparently are better organized than you (with more employees, for example), and which would be in a better position than you to implement the strategy you have just described.

SCHLUMBERGER SISTEMI: Naturally I cannot comment on what our competitors are doing. But look at this problem from a European viewpoint. We manufacture our test equipment in Europe and our factories are very close to our customers. Our engineering and technical research departments effectively providing support to our customers are located in Europe (and here we are not talking about the 40 or so employees typical of [the services provided by] some of our competitors in Italy). In my opinion, whether they are located in Paris, London, or Milan does not matter. They are still 150 people who are 1 hour flying time away, easily reachable, with a European mentality, and capable of understanding the customer's problems. We are the only company (apart from the local companies of course, such as Spea, Olivetti Tecnost, and Marconi in Britain) with factories in Europe. This means the availability of massive technical capabilities for solving customers problems, and not only in connection with ATE equipment. One should also remember that Europe is not a satellite of the United States. The laboratories we have in America are at the same technological level as those in England or France. There is no interdependence between these units. The whole Factron 700 series, for example, was designed and produced exclusively in Europe.

ELETTRONICA OGGI: You mentioned earlier that the card test equipment market in Italy is worth \$20 million. What is your share?

SCHLUMBERGER SISTEMI: We have a total world market share of 20 percent (for card testing). In Italy the situation is radically different. However, a 20 percent share in Italy is our medium-term objective. Local support, investments in research and development, and our efforts to promote the [company] will certainly help us to achieve this objective. We have been studying the market for about 1 and 1/2 years, and we have now created a local structure we consider to be optimal.

ELETTRONICA OGGI: In Italy you have local competition. We mentioned Spea and Olivetti Technost. How do you intend to get the better of competitors who, by definition, have a better position in Italy in terms of support and market presence?

SCHLUMBERGER SISTEMI: Our financial strength and our knowledge of the international markets are certainly in our favor. The investments needed to remain in the lead are enormous, and in my opinion are beyond the reach of a company like Spea or of any company which operates primarily at the local level. Furthermore, as I said earlier, 80 percent of our sales come from large companies with a multinational structure. Olivetti, Italtel, and Aeritalia need valid products not just for the local market, but for the whole world. These products have to be backed-up and guaranteed in all the corners of the globe.

Small and medium-size customers which are not looking for an international partner can obtain considerable advantages by working in collaboration with a company supplying solution and working with multinationals from whom he acquires know how which becomes his own property. We also work with the military sector, who frequently need to install our equipment on trucks, in environments which are potentially extremely dangerous for electronic equipment. We always succeed in meeting the specifications. This sort of experience teaches us the "tricks of the trade" which we often use to improve the quality of our standard products.

ELETTRONICA OGGI: If I understood correctly, the key words used by Factron are "customizing" and "networking". We have already discussed the former, but could you now explain what you mean by "networking"?

SCHLUMBERGER SISTEMI: Our architectures are open, based on DEC products such as VAX and physical connections such as Ethernet. They are standard products which are widely used in industry and for which we are developing the most suitable software for the application of the customer. With the Schlumberger Sistemi organization, we are able to offer a series of complete related services which range from the initial design phase to the automatic testing phase. In other words, a truly integrated system able to produce an effective increase in productivity in the design-production cycle.

8618

CSO: 3698/M366

## CIPI APPROVES ITALIAN R&amp;D PROJECT FUNDS

[Editorial Report] Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian No 128 on 4 June 1987 publishes resolutions adopted by the Interministerial Committee for the Coordination of Industrial Policies [CIPI] concerning the admission of Italian industrial research projects to the Special Fund for Technological Innovation established by Article 14 of Law 46 of 17 February 1982. In CIPI's 8 April session, the following company projects were admitted to the fund:

GTE Telecommunications Inc., large company classification

Program: New small-capacity digital radio links for telephone and/or data point-to-point transmission in the 13, 15, 18, 19, and 22 GHz frequency ranges.

Conditions: (ex. art. 16, Law No 46/82) 19 December 1986; resolution of the Minister for Trade and Industry.

Place of execution: Marcanise (Caserta region)

Form of financing: Credit available at an annual rate of interest established by article 15 of Law 46 of 17 February 1982.

Maximum amount: 55 percent of the allowed costs equal to 7,215.037 million lire in the form of easy credit to be allocated to the southern sector.

Amortization: 10 years, in addition to the 5 year period established for use and pre-amortization from the date the contract is signed.

Starting date of the program: 1 October 1986

Expected completion date of the program: 31 December 1989

Luigi Franchi Inc., large company classification

Program: Research and development of a computerized multit spindle forming machine for contour milling of carbon-fiber composites for structural components in the aerospace and automobile industries.

Conditions: (ex. art. 16, law No 46/82) 27 November 1986; resolution of the Minister for Trade and Industry.

Place of execution: Brescia

Form of financing: Credit available at an annual rate of interest established by article 15 of law 46 of 17 February, 1982.

Maximum amount: 45 percent of the allowed costs equal to 3,050.595 million lire in the form of easy credit.

Amortization: 10 years, in addition to the 5 year period established for use and pre-amortization from the date the contract is signed.

Starting date of the program: 1 September 1984

Expected completion date of the program: 30 September 1987

Montedipe Inc., large company classification

Program: Development of manufactured products made of advanced polymer materials with polyurethane, polystyrene, and modified matrices and a block-copolymerized base for applications in the sector of small-and medium-production automobile manufacturers.

Conditions: (ex. art. 16, law No 46/82) 30 January 1987; resolution of the Minister for Trade and Industry.

Place of execution: Porto Marghera, Mantua, and Bollate

Form of financing: Credit available at an annual rate of interest established by article 15 of law 46 of 17 February 1982.

Maximum amount: 55 percent of the allowed costs equal to 6,736.441 million lire in the form of easy credit.

Amortization: 10 years, in addition to the 5 year period established for use and pre-amortization from the date the contract is signed.

Starting date of the program: 1 January 1987

Expected completion date of the program: 30 June 1990

S.I.T. La Precisa Inc., large company classification

Program: Development of a new generation of automation and control systems used in gas-powered devices for electronic handling of security, processing, and control functions.

Conditions: (ex. art. 16, law No 46/82) 27 November 1986; resolution of the Minister for Trade and Industry.

Place of execution: Padua

Form of financing: Credit available at an annual rate of interest established by article 15 of law 46 of 17 February 1982.

Maximum amount: 45 percent of the allowed costs equal to 3,343.062 million lire in the form of easy credit.

Amortization: 10 years, in addition to the 5 year period established for use and pre-amortization from the date the contract is signed.

Starting date of the program: 1 September 1984

Expected completion date of the program: 30 April 1989

8615

CSO: 3698/M335

## ITALIAN R&amp;D, PLANNING AGENCIES APPROVE PROJECT FUNDS

[Editorial report] Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian on 24 and 25 June 1987 publishes resolutions adopted by the Italian Ministry for Scientific and Technological Research [MRST] and the Interministerial Committee for the Coordination of Industrial Policy [CIPI] concerning the admission of Italian industrial research projects to the Special Fund for Applied Research. The MRST resolution of 9 June admits the following company projects to the fund:

Fiat Aviation S.p.A., Turin, large company classification.

Location of research: Northern Italy

Program: "Design and development of a turboshaft engine" (project no. 49210).

Form of financing: easy credit available at an annual interest rate established by Treasury decree; subsidy.

Maximum amount: a) easy credit: 35 percent of the allowed costs of 1,681 billion lire; b) subsidy: 35 percent of the allowed costs of 1,681 billion lire (constituting 100 percent of the required financing).

Duration: 8-year amortization period in addition to the time needed for the research; the latter is not to exceed 4 years and 6 months.

Amortization: Sixteen semi-annual equal-deferred installments, inclusive of capital and interest, starting from the second due-date following the effective date of completion of the research program.

Starting date of the research: 1 February 1986.

Special conditions: Joint technical documentation with the Alfa Romeo Avio S.p.A. (Naples) project no. 47878

Technobiomedica S.p.A., Rome, Himont Italy S.p.A./Orthopedic Department Rizzoli S.p.A., Milan, large company classifications.

Location of research: Northern and Southern Italy

Program: "Polymer biomaterials" (project no. 47982).

Form of financing: easy credit available at an annual interest rate established by Treasury decree; subsidy.

Maximum amount: a) easy credit: 1,227 billion lire, or which 947 million lire, equal to 35 percent of the allowed costs, equal to 8.125 billion lire, for the north, and 280 million lire, equal to 40 percent of the allowed costs, for the south; b) subsidy: 1,227 billion lire, of which 947 million lire, equal to 35 percent of the allowed costs, equal to 8,125 billion lire, for the

morth, and 280 million lire, equal to 40 percent of the allowed costs, for the south.

Duration; 8-year amortization period in addition to the time needed for the research; the latter is not to exceed 4 years.

Amortization: Sixteen semi-annual equal-deferred installments, inclusive of capital and interest, starting from the second due-date following the effective date of completion of the research program.

Starting date of the research: 1 March 1986.

Special conditions: The following terms must be met by Himont Italy S.p.A. and Orthopedic Department, Rizzoli S.p.A.:

a) the following commitments with regard to Technobiomedica:

1) prepayment of the research costs, assuming responsibility for those costs not covered by the financing and for the financial commitments concerning preamortization;

2) responsibility for possible early repayment, during the period that funds are provided; this commitment must be supported by a fiduciary guarantee (proportional to the two companies, participation in the research) on the total financing.

3) agreement made with IMI to release Techobiomedica from any obligation to repay the financing, thereby making Himont Italy S.p.A. and Orthopedic Department, Rizzoli S.p.A. responsible for the latter.

The CIPI resolution of 28 May admits the following companies to the fund:

Breter S.p.A., large company classification.

Program: Technological process and product innovation for the assembly of electromechanical components using electronically controlled automated flexible assembly lines.

Eligibility: (ex art. 16 of law no 46 of 1982): resolution of the Minister for Industry of 27 February 1987.

Place of execution: Paderno Dugnano (Milan).

Form of financing: easy credit available at the annual interest rate established by article 15, law no 46 of 17 February 1982; subsidy provided under the third sub-paragraph of article 15, law no 46 of 17 February 1982.

Maximum amount: a) easy credit: 27.5 percent of the allowed costs of 813,405 million lire; b) subsidy: to be calculated by the Ministry of Industry on the date of stipulation of the contract under the third sub-paragraph of article 16, law no 46 of 1982, on the basis of 27.5 percent of the allowed costs, applying the calculation criteria stipulated in article 15 of the aforementioned law.

Amortization: 10-year amortization in addition to the 5-year period of utilization and preamortization starting from the date of stipulation of the contract.

Starting date of the program: 1 January 1986.

Estimated date of program completion: 31 June 1988.

IMEC-Milan Electroceramic Industry S.p.A., small company classification.

Program: Process and product innovation for new ceramic technologies and for innovative products based on advanced ceramics.

Eligibility: (ex art. 16 of law no 46 of 1982): resolution of the Minister for Industry of 27 February 1987.

Place of execution: Caravaglio (Bergamo).

Form of financing: easy credit available at the annual interest rate established by article 15, law no 46 of 17 February 1982.

Maximum amount: a) easy credit: 45 percent of the allowed costs of 1,134,616 million lire.

Amortization: 10-year amortization in addition to the 5-year period of utilization and preamortization starting from the date of stipulation of the contract.

Starting date of the program: 31 May 1984.

Estimated date of program completion: 30 April 1988.

8616

CSO: 3698/M359

## EC TO INTENSIFY ADVISORY SERVICE TO MIDSIZE FIRMS

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457, 12 Jun 87 pp 10-11

[Text] The EC Commission wants to intensify communications with small and midsize firms (KMU). Within the framework of this policy, beginning in October of this year, EC advisory offices will supply KMU's with information regarding the realization of European plans and will also accept suggestions or concrete requests for services.

The most important task of these advisory offices will be to prepare information on:

- development prospects during completion of the domestic market,
- markets (particularly public contracts),
- judicial, legal, social, and technical aspects of intra-community trade,
- EC financing instruments,
- legal regulations, norms, and technical standards,
- R&D and demonstration programs,
- Regional EC subsidies,
- industrial cooperation,
- trade relations outside the EC,
- professional training.

The advisory offices -- probably three in the FRG -- will make the necessary documentation available, provide help with formalities, and direct the industrialist to other offices if necessary. Furthermore, the EC Commission hopes to use the advisory offices to define future community actions more clearly and to direct them more efficiently.

At present the commission is evaluating applications for 28 pilot offices. These decentralized advisory offices will be linked to the traditional information channels of commercial service organizations which already operate on a public level. The host organization provides personnel, space, and communications; the commission takes care of training, supplies information and documentation, and provides initial financial assistance.

8617

CSO: 3698/M324



## FRG TAX REFORM THREATENS INDIRECT METHODS OF R&amp;D FUNDING

Duesseldorf VDI NACHRICHTEN in German 17 Jul 87 p 1

[Article by G.H. Altenmueller: "Funding Assures Room for Creativity: Curtailment of Funding would be 'Unproductive Idiocy'"]

[Text] The upcoming tax reform will also alter the research landscape. Forms of indirect support for research and development in the private sector, which up until now have been praised as progressive, will be given up. Even the scientists active in basic research fear that certain government funds may end up for them on the list of subsidies to be canceled.

More and more scientists at the universities are seeking financial help for their projects from the German Research Association (DFG). For in the last 25 years, the universities have been expanded at a cost of approximately DM 50 billion. The financially weak states, however, are no longer in a position to utilize this investment and to underwrite research projects. Funding is still available from the DFG, but it is also diminishing. With just over DM 1 billion annually, the DFG can barely maintain its present range of basic research. DFG President Prof Hubert Markl, speaking before the annual meeting of the DFG in Berlin on July 7, said that it would be "unproductive idiocy" if this were taken away. Budgetary cuts over the last two years and the opinion wide-spread among certain politicians that this is a case of subsidies which should be curtailed or eliminated in the framework of the tax reform and not of investment spending for the future, make the concerns expressed by Markl appear not unrealistic.

To be sure, Federal Research Minister Heinz Riesenhuber regularly assures everyone that he is providing particularly strong support for basic research--in recent years, its share in his budget has risen from 26 to 35 percent. However, direct support for individual projects as well as special funding handed out for particular purposes by the DFG account for the greatest portion of this increase. However, the most important criterium is thereby taken away: the review of a project's scientific value.

Now a new form of research support is moving into the foreground: allied research, linking the private sector and research institutes. Allied research helps build up and secure scientific capabilities in both basic and applied research. This is urgently needed. For after the BMFT has greatly reduced

its direct support of R&D projects in the private sector, now the indirect form of support--up until now a trademark of Christian-Liberal research policy--has also landed on the firing line. The program of the federal ministry for the economy, "Grants for R&D Personnel Costs," is expiring in 1988, and the BMFT program for covering increased personnel costs or the model experiment "Technology-Oriented Businesses", among others, will be terminated. The same is being considered for R&D investment increases. These reductions are undoubtedly being accelerated as a result of the suspicion that subsidies in the area of grants for personnel costs are being misappropriated, a matter currently under investigation by the attorney general.

However, the curtailment of subsidies in favor of tax reform is critical for this clean sweep which greatly exceeds DM 1 billion annually and which particularly affects small and mid-sized companies. While the Deutsche Industrie-und Handelstag [Chamber of Commerce and Industry] is backing the government in this regard, the Bundesverband der Deutschen Industrie [Association of German Industry] has strong reservations that the hard-won balance in research support could be lost. How questionable the expectations are that tax relief could stimulate businesses to greater R&D activity is shown by the BMFT's decision to begin to identify the problems which could develop for R&D in small and mid-sized companies and which will not be resolved through tax reform. The program to support contract research, which will remain in effect, could offer one approach to this; allied research might offer another. In any case, the BMFT wants to prevent the hard-won and--in comparison with Japan--still inadequate dynamics of private sector R&D from redeclining again.

12792

CSO: 3698/605

## MULTIYEAR STUDY SHOWS FRG INDUSTRY INCREASING ITS R&amp;D FINANCING

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 9 Jul 87 p 8

[Text] In 1986, expenditures for research in the FRG amounted to approximately DM 55 billion. The private sector accounted for approximately 70 percent of this figure. 85 percent of private sector funding for research was financed by the private sector itself. It is noteworthy that in recent years the private sector has increased its share of spending. While in 1971 the share financed by the private sector was 80.3 percent, in 1983 it had risen to 82.2 percent and in 1985 to about 85 percent. The most recent statistics concerning private sector research in the FRG is contained in the report: "Forschung und Entwicklung in der Wirtschaft 1983--mit ersten Daten 1985" [Research and Development in the Private Sector 1983--with Initial Figures for 1985], published by the Stifterverband fuer die Deutsche Wissenschaft. The dynamic development in research spending by the private sector can be seen from the following:

## Total Private Sector Expenditures for Research 1980-1985

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1980	DM 25.4 billion
1981	DM 27.8 billion
1982	DM 29.7 billion
1983	DM 33.1 billion
1984	DM 35.0 billion
1985	DM 40.0 billion, approx.

Based on these figures, the average rate of increase has been between 7 and 14 percent, with particularly high increases registered in recent years for private sector research in the FRG. In the governmental sector, on the other hand, the state has been less forthcoming, a position which also corresponds to the policies of the federal government. In the FRG, federal and state governments finance approximately 39 percent of research spending, 1 percent is financed by foreign and other interests, 60 percent by the private sector itself. While the states concentrates primarily on financing the universities, the federal government supports a wider spectrum of research activity. In the following section, the federal expenditures for research are given, based on the most recent statistics (Statistical Information of the BMFT [Federal Ministry for Research and Technology] Vol. 1/87).

The federal government controls approximately 24 percent of German research spending. From the distribution of federal funding, no conclusion can be drawn regarding the distribution of research spending in Germany. In the private sector, the division of research spending is known only according to the various economic sectors, but not according to particular research fields. As a result of the restructuring of research policy, the federal government has in recent years reduced market-oriented research, while research for long-term government programs and defense research have been expanded.

Research Spending by the Federal Government  
(in millions of DM, according to research fields):

Research Field	1985 Actual figures	1986 Projected figures	1987 Projected figures
1. Basic Research			
Universities and Sponsoring Organizations	2,254	2,438	2,484
2. Oceanography and Marine Technology	230	256	239
3. Space Research	831	982	1,124
4. Energy Research	2,150	1,835	1,519
Nuclear Research	1,565	1,559	857
5. Environmental Research	587	627	665
6. Health	377	384	421
7. Humanizing of Work	117	131	137
8. Information Technologies	624	786	854
9. Biotechnology	148	181	222
10. Materials Research	352	383	448
11. Aeronautics	330	571	693
12. Transportation Research	211	211	239
13. Geosciences	143	106	123
14. Planning	162	145	151
15. Food, Agriculture	300	293	287
16. Educational Research	112	127	126
17. Innovation and Conditional Frameworks	586	756	753
18. Technical Information	69	91	85
19. Humanities and Social Sciences	219	243	252
20. Other Areas	73	91	122
Total Civilian Research	10,175	10,637	10,945
Defense Research	2,473	2,590	2,797
Total Government Research	12,647	13,228	13,742

Government spending for civilian research has increased in recent years by an average of three percent in the FRG. This occurred completely contrary to the increased spending by the private sector for research purposes. A structural change took place within these expenditures, which can be characterized as follows:

- increased spending for space research, health and environmental research;
- decline in energy research, particularly for nuclear energy;
- increase of over 100 percent for aeronautical research in two years, as a result of the research activities of the ministry for the economy which are related to the Airbus project.

Federal Spending for Research  
(According to Recipient Groups, in DM million)

Recipient	1985 Actual	1986 Expected	1987 Expected
1. Federally-owned R&D facilities	1,001	946	960
2. State and Municipalities	1,013	1,096	1,125
3. Scientific Organizations	4,010	4,380	4,585
4. Private Sector	5,615	5,639	5,709
Portion thereof BMFT	2,525	2,421	2,225
Portion thereof BWWi	899	926	1,013
Portion thereof BMVg	2,081	2,174	2,350
5. Foreign	1,007	1,167	1,363
Total	12,647	13,228	13,742

With regard to this spending, the following fact is noteworthy:

The economic assistance of the federal government in the area of research is stagnating at about DM 5.6 billion. This is largely due to the fact that the research ministry has cut its funding for research in the private sector by 10 percent over the past two years. By contrast, the defense ministry and the economic ministry increased research spending for the private sector. In the meantime, the DM 3.3 billion in private sector funding spent by the ministries of defense and the economy greatly surpass research spending for the private sector by the ministry for research. This is a new development. While the research minister is concentrating on long-term programs that go beyond the more narrow private sector, aeronautics research is expanded through the ministry for the economy. In part this represents subsidies which are reflected on the balance sheet under research.

The winners in the increased spending by the federal government in research in recent years are also the scientific organizations, while the federally-owned research establishments continued to be funded at a low level. Financing abroad is also being increased, largely due to the transfer of space research tasks abroad; this returns, however, to Germany in the form of backflows.

## OPERATIONAL STAGE OF EC SPRINT PROGRAM OUTLINED

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 458, 29 Jun 87 pp 11-12

[Report: "EC SPRINT Program for Innovation and Technology Transfer"]

[Excerpt] Previous efforts within the framework of the European "Plan for a Transnational Development of the Infrastructure for Support of Innovation and Technology Transfer" should be continued and strengthened. The Council of the European Community has made this decision, emphasizing the necessity for appropriate measures such as training specialized consultants for technology transfer, innovation management, and investment financing in order to mitigate existing differences among individual member states with respect to consulting and support capacities, particularly for small and medium-sized businesses. Based on to previous results and experience, it will be necessary to provide for thorough evaluation over an adequately long and hence reliably predictable period of time in order to gather data so that proposals for a five-year program for transnational support of innovation and technology transfer (1989 to 1994) can be fully documented. Therefore it would be appropriate to extend the plan for the time being until 31 Dec 1988 under the new title "Strategic Program for Innovation and Technology Transfer (Program SPRINT)" and compile a current list of priority projects for this period of time. 8.6 million ECU are supposed to be set aside for this revised program. 18.6 million ECU are available for implementing the entire program.

13127

CS0: 3698/M355

## DEUTSCHE BANK CRITICIZES EUREKA OBJECTIVES

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATION in German No 458,  
29 Jun 87 p 5

[Report: "Deutsche Bank Responds to EEC EUREKA Initiative"]

[Excerpt] The Deutsche Bank has warned against overestimating the European EUREKA research initiative. The HANDELSBLATT (118/24 Jun 87) states that EUREKA must not be misused for an "undifferentiated race to catch up" with the USA and Japan in all areas of high technology. Otherwise one runs the risk that tax funds will be used to encourage overcapacities, primarily in the area of computer and semi-conductor technology. Although this would further European independence in this area, it would not contribute to optimum distribution of labor in the world economy. The Deutsche Bank considers it more important to implement the European internal market, a process which it acknowledges Eureka could accelerate, for instance through agreement on uniform technical specifications and standards, as well as approval guidelines.

13127

CS0: 3698/M351

## BRIEFS

AUSTRIAN RESEARCH ADVISORY SERVICE -- A new medium term business concept for the years 1987 to 1991 has been presented by the Austrian Research Center in Seibersdorf (OFZS). The fundamental concern of the program is the expansion of technology advisory services and services for small and medium size domestic firms. In addition, there is a trend to increase the amount of financing provided by the research center itself by approximately 50 percent by the early 1990s (the remainder is provided by the Ministry of Science). The program provides for close cooperation with economic subsidy institutes and interest groups through the research center's existing scientific contacts with university and non-university research institutes in the area of basic research. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 457, 12 Jun 87 p 14] 8617

CSO: 3698/M326



## COMPUTER EQUIPMENT AT BUDAPEST INTERNATIONAL FAIR

Budapest COMPUTERWORLD SZAMITASTECHNIKA in Hungarian No 13, 24 Jun 87 pp 1-8

[Text] 386 Micro (page 1)

We speculated in our previous issue: Will there be a 386 microcomputer at the BNV [Budapest International Fair] and if so at whose stand? Well, one of the foreign exhibitors brought its Multitech 386 machine, but even for it only the BIOS of the machine betrayed the presence of the microprocessor, a lay visitor would not notice that it was not a common AT.

The reason for the modesty was that the organizers of the exhibit asked everyone in advance not to irritate the sleeping lion, the compilers of the Paris COCOM list. Seeing the exhibit we brooded whether we might not put together an embargo list of a few peak technology products instead of politely warning about the other. For example, in the Novell network of the Instrument Technology Small Cooperative we saw three serving units; beside a machine compatible with the 386 and Eaststar, containing two 80286 microprocessors, there just happened to be an AT, the network service unit most commonly used in the Novell networks sold in the West. In addition, Instrument Technology successfully exports to Western countries more advanced than we their Arcnet network coupling cards. But after the Hannover discussions, which seemed successful, the small cooperative has not received, for the time being, the right to trade Novell in Eastern Europe--for embargo reasons....

The third firm which exhibited a 386 compatible machine was Szamszov [Computer Technology Small Cooperative], which was not ashamed that they were among the first in Hungary who could call this technology their own--embargo here or there. It is true that for the time being they were not accepting orders for the machine although at the 5G stand, where a 386 machine was not set up, they were promising July delivery, for 998,000 forints! The 5G Small Cooperative is not only forging ahead toward 32 bits in the PPC [professional personal computer] category but also, beginning in January, is delivering a 32 bit version of their Rair supermicro, which counts as a sensation because the Rair was the first in the world in use of the Intel 32 bit microprocessor in this computer category.

#### Terta's TPC/XT (page 2)

In issue 87/4 of the publication titled "compuTREND" we could read that the Telephone Factory (Terta) had purchased from the Instrument Technology Small Cooperative a license for their IBM XT compatible computer. Additional details about the PC, exhibited at the spring BNV, are now known. The size of the central memory can vary between 128 and 640 kilobytes. The card controlling the graphics screen (with a standard, Hungarian or Cyrillic character generator) is capable of controlling a monochrome or color monitor.

In the character mode it can display 25 x 40 or 25 x 80 characters on the screen; in the graphic mode it can use a resolution of 320 x 200 or 640 x 200 points. Terta is offering three types of keyboard for the TPC/XT--a standard English keyboard, a keyboard containing the entire Hungarian letter set and a Cyrillic keyboard. With the aid of various data transmission modems the TPC/XT can be connected as an intelligent terminal to a near or remote large computer (it can emulate IBM 2780, 3270, etc. terminals). The capacity of the 5.25 inch double-sided floppy disk which can be used is 360 kilobytes. That of the Winchester type hard disk store is 10 megabytes. We are informed that the TPC/XT will not be a product this year.

#### Videoton ESZ 1011 Plus (page 2)

Sale of the ESZ 1011 Plus, the new and most powerful computer system of Videoton, began this year. The new system, with 4 megabytes operational memory, several hundred megabytes of exchangeable disk stores and the new network supplement to the database management system, can be used as a multiple work station, real time information system or as the central, database management computer for a network made up of personal computers. The price of the TTR-NET database management supplement which makes possible cooperation between the ESZ 1011 and PC's is 195,000 forints. A logical maximum of 160 microcomputers can be connected to a database managed on an ESZ 1011--if strict rules are observed.

#### Thermonuclear Fusion Simulator (page 2)

The simulator shown at the stand of the Hungarian Academy of Sciences provides digital and analog signals to check a complex automation system for experimental thermonuclear fusion equipment and to test the programs operating the system. With its aid the checking and "program debugging" can be done without making use of the fusion equipment.

The central unit of the simulator, made up of elements of a real time CAMAC (Computer Aided Measurement and Control) peripheral system, is a microprocessor frame control. Its program provides the analog signals and measurement initiation synchronization signals according to given parameters with quartz controlled timing through output registers and digital-analog converters. The time function of the signals and the operational parameters can be followed on a color graphics screen. The simulator was developed at the Central Physics Research Institute.

Among the many instruments and strongly built special equipment and avoiding the crowd swarming around the new Zaporozhets, we were happy to discover at the Soviet stand two computers which seemed to be IBM compatible PC's and a mini configuration including GDR and Polish peripherals.

Seeing the former we immediately thought that maybe this was the SZM 1810, announced in our journal also, the Soviet PC which may be sold here as well! So we looked suspiciously at the sign placed on it--Why did they call them the DVK-4 and DVK-3? But the experts, ready to help, cleared it up. There was no mistake, they had brought to the BNV personal computers which were entirely Soviet developed, but which were not IBM compatible.

The difference between the two models is only in the peripheral structure. Both are based on the KM1801VM3 (there is no Intel equivalent) 16 bit microprocessor with 304 instructions and a speed of 1 MIPS. Their operational memory now is 1 megabyte but they plan a 4 megabyte version in the future. In addition the DVK-3 has two 5.25 inch floppy disk units of 440 kilobytes each and the DVK-4 has one 440 kilobyte floppy and one 5 megabyte hard disk unit. The larger capacity machine is sold with a 16 color monitor and the smaller with a black-white monitor. Their operating systems are not DOS compatible so although BASIC, FORTRAN, Pascal and FOKAL compilers have been prepared for them the DOS programs can be used only after rewriting. Finally the price of the two machines may be of interest; the DVK-4 costs 18,000 rubles and the DVK-3 costs 15,000 rubles.

A cassette tape recorder, mini-TV micro was exhibited between the two personal computers. It was not by chance that the school computer was in the vicinity of the larger DVK's. A number of small micros can be connected to the latter as a central machine thus creating a teaching system in which the teacher guides from the DVK the work of students on the VK-0010's.

It was unfortunate that lacking descriptions we could learn the data on the DVK's and the VK only verbally. We did get a detailed prospectus about the configuration consisting of the Soviet central unit, Mera terminal and Robotron floppy disk unit and printer from which we learned that it was indeed the SZM 1810. The Elektronmas production association in Kiev manufactures the IBM PC compatible central unit in two versions. One uses the K1810VM86 microprocessor, corresponding to the Intel 8086, and the other uses the K5801K80A, corresponding to the Intel 8088.

Although there was only one processor in the SZM 1810 exhibited at the BNV the architecture permits more (a maximum of eight) processors. The capacity of the operational memory in the smaller capacity version is 8 kilobytes and it is 256 kilobytes in the larger. The background store for the machine shown was the Robotron SZM 5640, a 0.5 megabyte 5.25 inch floppy disk unit; but manufacture of 20 and 160 megabyte hard disk units will begin soon in the Soviet Union.

The operating system of the SZM 1810 is CP/M-86; they plan a DOS compatible system for the future. For the time being the prices are not known.

#### Romanian Minicomputers (page 4)

Three products, each in a different category, could be seen at the exhibit of Romanian computer technology. The first was the Junior microcomputer. On the basis of its name we thought it was a school and home computer but it turned out that the designers of the Z80 based microcomputer also intend their child for professional users. The Junior runs under the CP/M operating system; its program language is BASIC.

In issue 87/3 of COMPUTERWORLD/SZAMITASTECHNIKA Peter Broczko described in detail last year's microcomputer offering of the socialist countries. He mentioned the Junior too, adding that the first Romanian XT compatible PC was promised for 1987. Well, we could not see the latter yet in Budapest and in general they could provide no information about their PC plans.

They did exhibit a minicomputer called the Coral 4021. The 4021 is the medium level member of a four member PDP compatible family, corresponding to the PDP-11/44. Beside it stood an American--CDC made--printer so we asked about the Coral magnetic tape unit, on which we saw no trademark: Where did it come from? We learned that it also is a CDC product, but that Romanian manufacture of it has already begun.

The advance of CAD/CAM applications left its mark on computer technology at the BNV in general. In the peripheral area also Hungarian and foreign firms exhibited many more graphic displays, digitizers and plotters than earlier. The Romanian stand was no exception. A built-in Intel 8080 microprocessor controls the ICT-800 plotter. It draws on an 820 x 1600 mm area with two pens; it can be connected to computers through RS 232 and Centronics interfaces.

We received no reports about deals signed.

#### Robotron Computer Hardware (page 4)

The GDR 8 bit office computer captured domestic professional interest not so much with its technical parameters as with its series size and--no doubt deriving therefrom--its price. Last year they made more than 20,000 of the 5,400 ruble microcomputers and the plan for this year is the same size. At the Robotron stand they were happy to talk about an IBM compatible 16 bit PPC [professional personal computer] to appear in September; they intend to manufacture a series of 80,000 (!) of them.

Although we could see only a mock-up of their new large computer, the third generation ESZ 1057, they are expected to deliver the first unit to Szamalk [Computer Technology Applications Enterprise] this fall. The capacity of the operational memory is 16 megabytes and the speed of the equipment is 1 million operations per second. The advanced version of the OS/ESZ operating system is supplemented by SVS 7 and SVM 3 virtual memory management programs. The system philosophy was governed by flexibility and multiple use abilities. They are offering for it many applications program packages and peripherals from CAD/CAM work stations to laser printers and various teleprocessing units.

We could also see an image processing system (A 6471) at the Robotron stand. They are offering medical, biological and materials testing program packages for the system which consists of a control computer, graphics unit, color monitor, video camera, microscope, storage and printing units.

The GDR's largest exhibitor also offered many types of printers. At this year's spring Leipzig Fair they exhibited for the first time the K 6320 matrix printer family which has a maximum speed of 165 characters per second. They offer the K 6327 model for text processing tasks; its 18 x 36 point pin unit provides near letter quality printing.

#### Bulgarian Printers, Industrial Computers (page 5)

The Intelle XT and AT are computers of Japanese origin assembled in Bulgaria. They are selling the XT version for 2,800 dollars with 640 kilobytes RAM, a 10 megabyte hard disk and 360 kilobyte floppy disk unit, a Star SG 15 matrix printer and MS-DOS version 3.10. We found three new items at the Izot-Impex exhibit compared to the Bulgarian computer technology exhibit held recently in Budapest. They are making the Pravets E, Apple compatible, modular, industrial computer in a two processor version. The Mechatronika factory in Gabrovo is making 50-100 of the Mikronika P 297 x-y plotters per month. This peripheral, drawing on A/3 format paper, can use eight pens and has a precision of 0.1 millimeters. Also at Gabrovo they are making the Mikronika D297 digitizing tablet which is A/3 size and has a precision of 0.125 millimeters.

#### Display of Polish Equipment (page 5)

One of the new items from the Elwro enterprise was the Elwro 800 microcomputer which can handle a maximum of 16 work stations and can work with 16 (!) different operating systems (including one corresponding to MS-DOS). At the exhibit it operated four Videoton CRT terminals under the MP/M-86 operating system. Another new item from Elwro was the report that they would offer the ESZ 1034 computer in Hungary; they would like to deliver the first system this year.

At the Metronex stand we could see the XT compatible Mazowia 1016 personal computer and two new matrix printers, the D-100M and D-100E from the Mera firm. Both peripherals can print a maximum of 80 characters per line.

#### Hungarian Image Processing System (page 6)

Developers at the Mathematics Laboratory of the SZKI [Computer Technology Research Institute and Innovation Center] hope that users will find their image processing system as good and useful as its name. It can work with a Proper or any other IBM compatible computer.

The PRIMA (PROper IMAGE Analysis) is characterized by modular construction and is thus expandable, a basic requirement for such multipurpose systems because of the use areas which often differ so much from one another. The size of the image which can be processed is limited only by the storage capacity. The system is suitable for image digitization, relocation of image parts, recoloring of images, performing arithmetic and logical operations among

images, preparing statistics, designating the contours of defined areas and filling in areas.

Two or three image planes can be defined with the aid of the color image processing processor. Other displays in addition to SZKI products can be connected to the image processor.

#### Physics Institute Image Processor (page 6)

The KFKI [Central Physics Research Institute] is offering an image processing system for scientific purposes based on developments by the SZKI. The unit, which can be connected to an IBM PC type personal computer, consists of display electronics, a positioning button and an interface card which fits into the personal computer in addition to the color display and the operating program system.

The display is a critical element of image processing systems. In the case of the KFKI product the number of pixels is 512 x 512 with 8 bits per point. As many as 256 colors can appear on a screen, but these can be selected from a palette of more than 16 million hues. (The size of the color table is 256 x 3 x 8 bits.)

The software shipped with the system consists of applications routines and a subroutine set aiding preparation of programs which can be written by the user--for example, display, image manipulation and image processing basic routines. It can prepare histograms and transformations and can do Fourier transformation or image unification.

The KFKI promises to constantly expand the library of subroutines written in FORTRAN, C and ASM-86 languages.

#### Hungarian CAD/CAM Systems (page 7)

One can mention as a chief virtue of the Hungarian CAD/CAM exhibits that we could see working systems and could handle uniquely shaped pieces designed with CAD software and processed with a CNC machine tool.

One could have read already in our journal (number 10-11, 1987) about the CAD systems prepared for the KFKI TPA 11/540 and 11/580 computers and about the Videoton VT-32 graphic work station on which they ran the 3-D pipe network designing software. They recommend its use primarily for chemical industry and energetics areas, for example to design boilers, water pipe systems and nuclear power plant pipe systems. And we have also already reported on the ASKA finite element dimensioning system of Szamalk, which those interested could dip into through a terminal.

After so many articles we could finally see, in a manufacturing process, the FFS system of MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences]. This free form surface designing software is used at the Machine Tool Factory of the Csepel Works to prepare tooling for a number of new products. With operational experience and after a year of experimental manufacture they are awaiting orders for next

year with the aid of a new module which interprets mechanical drawings. Or they will undertake designing if the customer has his own 3-D processing machine.

The new SZM MK 500 manufacturing module of the Csepel Works is nothing less than a versatile metal cutting machine with high level controls. It is a module because together with several fellows it can be part of a flexible, integrated manufacturing system. Unfortunately we could see only a mock-up of the latter.

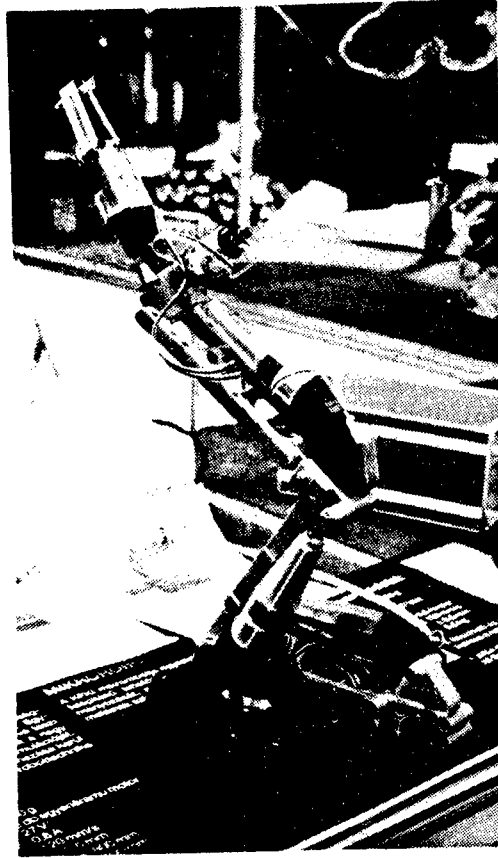
It is a general characteristic of machine tool control consoles and cabinets that they follow the trends of the computer market. Controls with color screens and standard alphanumeric inputs and outputs are spreading and can be called built-in CNC's. The technologist of today need not even stick his nose into the shop in order to plan the operations. The most common Bosch and Siemens type controls of foreign machine tools can do everything. The control cabinet exhibited at the stand of the Landis and GYR firm was an IBM PC compatible with 3.5 and 5.25 inch floppy disk stores, serial and parallel outputs and servo controls, measurement data collector and even remote data transmission channels.

The development is well indicated by the EMCO system which can be seen in our front page photograph. Thus far the outstanding offer from the Bull and Strunz firm has been accepted 300 times in our country and they now have orders for ten complete systems (from the private sector as well). The desk sized metal cutting machines (from lathe through milling to tooth cutting machine) can be connected through their controls into a network which can include several robots or even several professional personal computers! This truly integrated manufacturing system can be used primarily to teach CAD/CAM, CAE, CIM, etc. and is so used throughout the world. After desktop publishing will we now see desktop manufacturing?

#### Computers, Printers for Soviet Union (p 8)

It is a tradition of almost 15 years that by the time of the investment goods fair the Videoton Electronics Enterprise has succeeded in preparing its Soviet market deals for the coming year and there is almost always a festive moment when they sign the contracts at the BNV. This moment was not missing from the 1987 spring BNV; on the day before the end of the fair, after long preparatory work, they signed civil law contracts representing 43 percent of the trade expected for 1988. The larger part (56 million rubles) of the 67.2 million ruble transaction involves various computer systems (ESZ 1011, RPT, VT-20) while Videoton will deliver line printers and subassemblies worth 11.2 million rubles.

At a joint press conference held by the SZM Impex enterprise of the V/O Elektronorgtechnika and V/O Soyuzzagranpribor all union association and Videoton they announced that new forms of cooperation may develop in the near future. The idea of a joint software house is so far advanced that they have already begun to prepare the founding documents. They would also like a joint technical service enterprise; according to present plans this could be formed by the end of the year. At the time of the fair the Soviet partners were thinking about bringing together in a joint enterprise the experience and technological expertise in the area of producing high quality peripherals but probably such an agreement could not be signed before the middle of next year.



#### Hungarian Microrobot (page 7)

We could see microrobots with six degrees of freedom and small computer control at two places at the BNV, at the stands of the Central Physics Research Institute and of FOK-GYEM [Precision Engineering and Electronic Instruments Manufacturing Cooperative]. This means that devices serving to teach robot technology and simulate the work processes of large industrial robots, built in an easy to understand way, have already found manufacturers. We learned that FOK-GYEM will begin manufacture this year of the robot developed for laboratory and teaching purposes. It will have a price around 30,000 forints.

The baby robot can bear a load of 200 grams, its operating speed is 120 millimeters per second, the maximum reaching height is 800 millimeters, the maximum reaching distance is 500 millimeters and its total weight is 8.5 kilograms.

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CSO: 2502/84



## CHANGES SEEN THREATENING HYDROCARBON PRODUCTION IN HUNGARY

## Viability Questioned

Budapest FIGYELO in Hungarian No 30, 23 Jul 87 p 5

[Text] Motto: "Our position is not easy when we must secure the energy source of the future with current prices and yesterday's economic policies of governments"--remarked one of the speakers at an international crude oil-economic conference last year. This statement is also a good illustration of the current situation of the Hungarian hydrocarbon industry which we present in the following on the basis of information received from the National Oil and Gas Industry Trust--thus, seen largely through glasses of the Trust.

The domestic hydrocarbon industry is concentrated in the activity of enterprises belonging to the National Oil and Gas Industry Trust (OKGT) making this organization one of the largest industrial entities of the country: on the list of the "Hundreds' Club" of FIGYELO, which includes the largest industrial units of the country, OKGT is first in domestic sales and export volumes.

Our crude oil production covers 20 to 25 percent, our natural gas production about 57 percent of the country's needs. The rest is imported from the Soviet Union, preponderantly in the framework of the ruble exchange, and it reaches the consumers after processing and distribution by the OKGT. The desired scope of import is determined primarily by domestic demands. However, in the course of hydrocarbon processing, some products invariably will have a larger yield than can be consumed domestically. This surplus is exported by OKGT, more advantageously than the industrial average.

Hydrocarbon production reached a peak in 1985 with 7.5 billion cubic meter of net dry natural gas and 2 million tons of crude oil. The efforts of OKGT will be aimed at merely maintaining the level of production even in the near future since our country can be considered already extensively explored and the hydrocarbon reserves yet to be discovered will probably be found mostly in small and occasionally in medium sized deposits. Under these circumstances, the increase in exploratory and drilling activities needed to preserve a healthy balance between production and research is accompanied by increasing costs.

Because of the increasingly unfavorable geological conditions, the research and development efforts, and equipment and production development necessitate increasing expenditures year by year. Nevertheless, the production cost of domestic hydrocarbons is only about a third even of the low current world market prices, that is, the domestic source is considerably more economical than the imports. The world market price of crude oil was \$18 in March this year while the cost of domestic crude oil production was only \$6 per barrel. The current production costs of domestic sources are an eighth of the the price of natural gas received through the "Testveriseg" natural gas pipe and a fifth of the price of crude oil received through the "Baratsag" pipeline.

It is improbable that a domestic cost increase or a drop in the world market prices of such magnitude would occur that it would cancel the considerable advantage of domestically produced hydrocarbons. The production costs of domestic hydrocarbon sources are expected to remain below the current world market prices for as long as 5 to 10 years. Consequently, considerable net income will be assured by crude oil and natural gas production not just now but even in the future. This is also reflected by the economic indices of OKGT. The rate of increase in added value, the cost-effectiveness index routinely surpassed the average industrial indices between 1980 and 1985.

The duties of the Trust for the Seventh Five-Year-Plan period were determined by the State Planning Commission in tune with the above data. In the framework of the targeted investment program, development of the means of hydrocarbon exploration equipment must be continued. During the plan period, a total of 35.5 billion cubic meter of net dry natural gas and 9.5 million tons of crude oil must be produced. In the interest of satisfying peak winter demands, expansion of the capacities of underground natural gas storage and the natural gas pipeline system must be continued.

The management of OKGT during the Seventh Five-Year-Plan period was regulated--at the end of 1985, prior to the drop in world market prices--by the Ministry of Finance that was acknowledged by the Trust under the conditions that prevailed at the time. Aware of the world market price conditions in effect at the time of the regulation, and of the developmental and financial responsibilities of OKGT, and also partially acknowledging the expected increases in the costs of hydrocarbon exploration, production, transportation and storage, The Ministry of Finance determined the KUTEFA [expansion unknown] system and the related tax benefits for the plan period and, to limit the purchasing power for developmental objectives, prescribed a so-called technical profit reduction.

Subsequently, however, there was a considerable change in the factors that determine the management of the hydrocarbon sector already at the beginning of 1986:

--a rapid and drastic drop in the prices of crude oil and crude oil products started on the World Market. The export prices of oil products dropped by 20 to 50 percent;

--domestic prices changed as did also certain elements of the general enterprisal income regulation involving also the OKGT.

As their combined effect, the annual profits of the hydrocarbon sector for 1986 were 37 percent below the previous year's profits. As a result of the drop in world market prices--relative to the results calculated on the basis of export prices projected at the time of the regulation of the Trust--OKGT suffered an 8.7 billion forint reduction of profits because of reduced income from prices and lowered returns through KUTEFA. Therefore, the relevant governmental committee resolved in 1986 that "in order to compensate for the 1986 export price losses of OKGT, budgetary support must be provided to an extent sufficient to maintain the security of enterprise management and to preserve the markets." The measures taken by the Ministry of Finance on the basis of this resolution (moderation of the export losses involving four targeted products through compensation up to the level of the domestic producer price), however, relieved the export price losses of the hydrocarbon sector only by about 2 billion forints.

The above mentioned resolution by the governmental committee also stated that "the extra costs associated with export must be assumed by the state budget." This, however, was not implemented.

At the same time, the domestic production cost of hydrocarbons underwent a change three times during 1986, compensating for a total of 2.65 billion forints of the export price losses of OKGT.

In the end, of the 8.7 forint export losses, a total of 4.8 billion forints were neutralized through the various offsets. Consequently, the 1986 export activity of OKGT closed with a deficit and preservation of the markets was endangered because the Trust cannot sustain additional losses on its own.

However, the profit losses caused by lower export prices could have been born by the hydrocarbon industry even without state support had the extent of KUTEFA payment not remained at the level determined on the basis of the earlier, high export price. Consequently, the question is not that the convertible foreign currency export of the branch must be supported but that the state should discontinue the non-normative, so-called technical profit lowering and should moderate the tax assesment aimed at withdrawing the income from mining production because such income had also decreased in the enterprise. If we accept that the funds derived from the exploitation of natural resources should accrue not to the enterprise but to the state budget, then we must also accept that, should this income decrease, the state's withdrawal should also be reduced. It should be acknowledged that, under current market conditions, such activity can contribute less to the support of other branches of the state economy.

The OKGT attempted to moderate the decrease in price-based income by increasing the amount of exports and, instead of the planned 1.33 billion tons, it sold 1.6 billion tons of various crude oil products. The price losses were reduced by about \$60 million through the increased amount; this, however, balanced only part of the loss. But, because even this export is only 8 percent of OKGT's natural goods production, the earlier average of a 2 percent profitability of domestic sales is in any case insufficient for the smooth management of the enterprise.

In spite of the significantly changed circumstances, the Ministry of Finance did put into effect the non-normative, so-called technical profit reduction to the tune of about 2.3 billion forints, set for 1986, in order to moderate the capital investment capabilities of OKGT.

Compared with the conditions known at the time when the OKGT activities have become regulated, not only the factors that influence the shape of the outcome have changed but the fundamental financial interests have also become directly affected by a very unfavorable decision: from the funds set aside from the outstanding profits in 1985 and saved for 1986, the State Planning Commission withdrew one billion forints through its 2 April 1986 decision. This unexpected decision considerably decreased the reserves of the Trust.

Management of the Trust is also hindered by the fact that currently they cannot enjoy the benefits of the several million forints of interest return associated with investment loans, or rather the thereby realizable profit tax benefits, because this sum was consumed by the loss of operating funds caused by the 37 percent decrease in profits.

At the end, by partially holding back on investments in progress, freezing wages and complete exhaustion of management reserves, OKGT avoided a basic deficit in 1986 although it had serious financing and management problems. But without changes in the current conditions, mostly in the budgetary relations of the Trust, financial and budget balance are slowly becoming questionable and the Trust, on its own, definitely cannot sustain its functioning ability on the long run.

The above described situation is also untenable because the Hungarian hydrocarbon industry is not a distressed branch even under the current world market prices. About 90 percent of the net income realized by OKGT, a sum of about 70 billion forints, goes into the state budget on various pretexts. However, the profits retained by the Trust are increasingly inadequate for maintaining the level of its capital equipment. When the management conditions were regulated, the contribution from their own funds to investments financed by credit and the necessary financing of enterprisal investments were set at such a low level that it does not even fully ensure the financing of investment at a maintenance level. The one billion forint operating reserve fund that was built from the outstanding results of 1985 also would have served to finance the development necessary to fulfill the production and export tasks.

The 1986 closing balance of the OKGT hydrocarbon sector was 6.3 billion forint. The operating fund balance projected for 1987, shows the absence of more than 600 million forints. This means that the required self-financing of targeted developments became uncertain and the achievement of enterprisal investments became doubtful.

Investments decided on by the enterprise, appearing in the developmental program of the Trust, are indispensable already in the near future for fulfilling the short- and longer-range production tasks. Developments must be adapted to increased demands for better quality crude oil products and, at the same time, environmental and health protection aspects are also gradually

coming to the foreground. In financing enterprisal investments, own sources should be supplemented by bank loans accepting the fact that, in this case, the loan sector is destined to evaluate the profitability of the developments. But the procurement and repayment of bank loans is hindered by the described "regulated state" because of the provision that the budgetary withdrawal of the net income produced by OKGT should not exceed the sum of normative taxation and the income withdrawal aimed at excess profit derived from mining production.

In the interest of normalizing the ability to function and thereby providing for a realistic, market oriented development of the hydrocarbon industry, it is necessary that:

--the 2.3 billion forint non-normative, so-called technical profit reduction--which had lost its timeliness in the meantime--be abolished,

--the KUTEFA system be modified taking into account the increasing domestic costs of crude oil and natural gas production and the drop in export prices,

--withdrawal of the one billion forint from the industry's own operating funds be repealed.

Because, in addition to maintaining the level of economical hydrocarbon production, the national economy has a considerable stake in undisturbed domestic supply and in the maintenance of the convertible currency export of natural gas and crude oil products, this must also be reflected in the specific regulation of OKGT, instead of post facto, case by case measures. It is not justified to subject the long-range development of the hydrocarbon industry to an approach defined by short-range budgetary deficiencies.

#### No Real Danger Claimed

Budapest FIGYELO in Hungarian No 30, 23 Jul 87 pp 5-6

[Interview with Jozsef Molnar, official of the Ministry of Finance by Emilia Sebok]

[Text] Thus, during the Seventh Five-Year-Plan period, the domestic hydrocarbon sector operates under conditions which deviate from those of normative regulation. This special regulation is spelled out in an agreement between OKGT and the Ministry of Finance that represents the state budget. As we have seen, the Trust is now taking exception to certain points of the agreement. What is the view of the other party? Jozsef Molnar, official in charge at the Ministry of Finance was questioned by Emilia Sebok.

[Question] How normative or special is the regulation of OKGT? Is maintenance of the special regulations justified in view of the changed market situation?

[Answer] The income regulation of the Trust, or rather that of its enterprise groups which have autonomous relations to the state budget, is basically normative. It is a fact, however that, in view of the special conditions of the hydrocarbon industry, the income situation of OKGT during the Seventh

Five-Year-Plan period is also influenced by a few important regulatory elements which differ from the norm. The question is dealt with by the 1985 agreement between the financial government and the Trust.

In the special regulation based on the agreement, the budget acknowledges a large part of the cost increases in geological research and in mining and it provides financing for these expenses by reducing KUTEFA which serves to remove mining income. In the interest of secure financing of developments in geological research and mining, which represent the decisive part of the targeted hydrocarbon industrial investments, we approved the formation of the Hydrocarbon Production Development Fund.

On the other side, however, we are enforcing a so-called technical profit withdrawal which can be viewed as special. On the one hand, it serves to hold back the outflow of excess investment purchase power in comparison with the hydrocarbon industrial investments called for in the intermediate-range national economic plan and, on the other hand, to keep the profits of the Trust at the necessary level. The amount of this withdrawal was set for the next five years in accordance with the 10.5 billion forint profit in 1985 and we did not change the amount when the real profit grew to 12.3 billion.

With the combined influence of last year's drop in world market prices, the budgetary interventions to moderate its effect and the elements of intermediate-range regulation, and as a result of these, profits at the Trust level decreased to 7.2 billion forints and this is why the Trust is protesting the maintenance of the withdrawal. Our position is that this agreement is valid for the entire duration of the Five-Year-Plan and, therefore, its removal because of the drop in the profit level of the starting year is not justified. By the way, the functioning of the Trust is assured at the current income level, in spite of the withdrawals.

[Question] In your opinion, then, the 1986 budgetary means to moderate the losses were sufficient?

[Answer] The income loss derived from the decrease in export prices of processed hydrocarbon products was moderated in the amount of 2.8 billion forint, by changes in the 1986 domestic producer prices. This moderating effect occurred because the total price of access to crude oil decreased more than the total income from the sale of the goods produced. This positive effect is expected to be even greater in 1987 because last year's price effects will now involve the entire year.

The former can also be conceived as indirect budgetary support because income withdrawal by the budget was moderated to an extent identical with the decrease in the crude oil price. In addition, OKGT also received direct budgetary support in the value of 2.2 billion forints in such a way that the export income of products that are under domestic price control was supplemented to match the domestic price income. By the way, this form of support will also be in effect in 1987.

[Question] Nevertheless, the operating fund balance of the Trust projected for 1987 still shows a deficit.

[Answer] I do not agree with this statement. The operating fund situation of the hydrocarbon sector of the Trust is in reality as follows: they have total funds of 10.1 billion forint made up of the 6.3 billion forint net income realized from their activities in 1986 and of other sources (mainly through the depreciation deduction), even while they built a 1.1 billion forint profit reserve. These sources in their totality correspond to the operating fund-utilization goals of the Trust.

[Question] But there is still some deficit!

[Answer] As perceived by the Trust, yes. Here we reached the topic where our opinions differ most strongly from the position of OKGT.

There are conceptual differences in the background of the differences in opinion: according to us, the domestic hydrocarbon industry should satisfy domestic demands on the intermediate- and long-range, this should be the main goal of the activities. Therefore, geological research, exploitation, and the functioning and development of an adequate level of processing and marketing to secure the domestic supply must be assured in the first place. The export of crude oil products and the export oriented developments of the processing industry should depend on national economic rentability which are also reflected in the income situation of OKGT. It is not in our interest to maintain in the long-range the budgetary support of exports. The enterprise should make rentability the gauge for attempts at export development, and this should be evaluated by the credit sector, rather than expecting supplementation from governmental finance.

The financial conditions for production and service, in order to ensure an adequate domestic supply, will always be provided by us. The target oriented and associated enterprisal investments, and investments made with World Bank loans ensure the necessary developments. Even beyond the specified, not freely utilizable sources, sufficient operational funds remain available to use for projects that depend on decisions by the Trust: supplementary investments needed for the adequate functioning of fixed assets and taxes on their accumulation, financial incentives for the workers, welfare benefits and other purposes. Thus, the Trust and the hydrocarbon sector are not lacking basic funds in 1987! There is no need for additional central resources for continued functioning. We consider the ability to function, as interpreted according to the above considerations, insured also for the remainder of the Seventh Five-Year-Plan period.

[Question] The profitability of exports is difficult to question as long as the costs of domestic production are merely a fraction of even the low current crude oil prices in the world market.

It is unwarranted to calculate the profitability of export on the basis of the favorable domestic production costs because it is decisively not based on the domestic raw material. The costs of imported basic material at the level of the national economy, and the processing and transportation costs must be taken into account as the basis for dollar production and, on this basis, the profitability of a significant part of the crude oil export can be questioned.

[Question] Nevertheless, even you do not doubt that the costs of domestic production are very favorable and this can remain so for quite a while in spite of the increasingly difficult conditions. Thus, the development of exploitation is definitely justified.

[Answer] The costs of domestic exploitation are indeed favorable and, therefore, the geological research and exploration expenses are secured by the budget in the form of the research and exploration fund that may be established at the OKGT to cover costs. We view this solution as returning a part of the state's entitlement from the exploitation of natural resources so that the Trust can use it to finance the research activities for future exploitation instead of burdening its own finances and, in the final analysis, its profit.

The development of exploitation takes place in the framework of the targeted investments of the hydrocarbon industry with the corresponding financing mechanism. There are two eminent themes here: development of research and exploration equipment, and investments for mining development. These goals are financed by the Hydrocarbon Production Development Fund as an enterprisal source which can similarly be formed on the basis of costs. Thus, the financing of the necessary development in research and exploration, and exploitation is assured through these two funds.

The equipment needed for maintaining the level of exploitation must be funded from the enterprise's own operating fund. For this, in our opinion, sufficient finances remain with the Trust. The increases in the current costs of exploitation are acknowledged by the regulatory system through the moderation of KUTEFA. Thus, real needs are receiving real funds.

2473

CSO: 2502/83



## NEW Nd PHOSPHATE GLASS LASER BY HUNGARIAN OPTICAL WORKS

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 5, May 87 pp 130-132

[Article by Dr Gabor Lupkovics, Central Optics Research Laboratory, Hungarian Optical Works: "Research on Applications of a New Type Pulse Operating Nd-Phosphate Glass Laser in the Laser Development Laboratory of the MOM (Hungarian Optical Works)." The first paragraph is the Hungarian summary.]

[Text] The article deals with the advantageous properties of a high Nd concentration phosphate-glass laser--from the viewpoint of certain uses. It discusses the novelty and mechanism of the passive Q switching and mode synchronization of the laser.

## Introduction

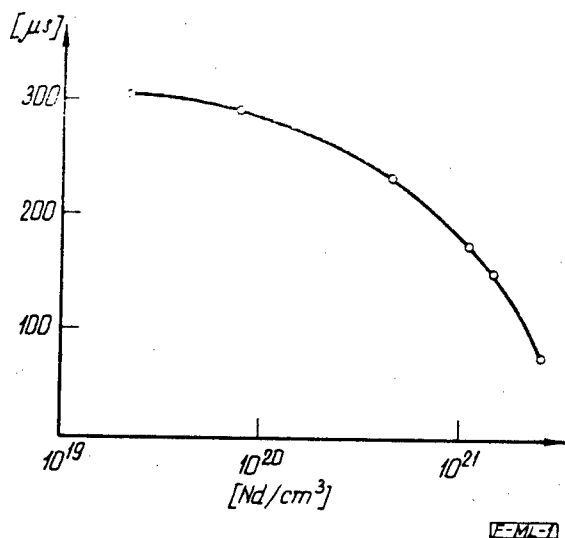
Use of the swiftly developing laser measurement technique puts ever more complicated and more difficult tasks before developmental laboratories. In many cases user needs--forced by "sharpened" parameters or the circumstances of use--lead to the discovery of new laser types or the development of radically new techniques. In the present case also a relatively new type of laser, its new type of Q switching and mode synchronization, make possible an especially demanding use.

## Nd-Phosphate-Glass Laser

Taking all use areas as a base the leading role among pulse lasers operating in the near infrared range is played today by yttrium-aluminum-garnet (YAG) lasers carrying  $\text{Nd}^{3+}$  ions. These lasers are suitable for the development of the most varied parameters; only the monocrystal growth technology limits a further exploitation of the possibilities. Namely, one of the basic facts is that in a crystal drawn from the melt the Nd concentration must be held stable within a narrow tolerance. On the other hand, without breaking up the crystal structure the absolute value of the Nd concentration cannot go above  $10^{20}$  Nd/cm<sup>3</sup>. But to achieve certain laser parameters--as we will show later--a high Nd concentration is absolutely necessary. Such a material is the Soviet Li-Nd-La phosphate-glass which provided a foundation for the creation of a special laser developed jointly by the IOFAN, KFKI [Central Physics Research Institute] and the MOM. This basic material can be contaminated with Nd in a broad range ( $0.2-2.7 \times 10^{21}$  Nd/cm<sup>3</sup>).

In contrast to other carrying mediums the duration of the excited upper laser level in this material changes only slowly with the contaminating concentration--as can be seen in Figure 1. Efficiency increases significantly for this reason. A problem is represented only by the worse heat conducting property, which limits the area of applications. For example, if its use is recommended at a higher repeat frequency because of its other good properties then the laser rod must be cooled (the limit is around 0.1 Hz, above that one should use water cooling). (1)

Figure 1.



In the laser device which was developed the active medium has a concentration of  $2.7 \times 10^{21}$  Nd/cm³, which does not cause an observable reduction in the quantum efficiency. In the free generation mode an efficiency increase of 20 percent could be attained. The width of the outgoing pulse semivalue is about 150 microseconds. (Another advantage is that excitation can be done with a simple flashing lamp.) We realized the free generation mode with an 80 mm resonator length with a flat (large radius) configuration in the multimode usual for YAG lasers. The wave length is 1.054 microns.

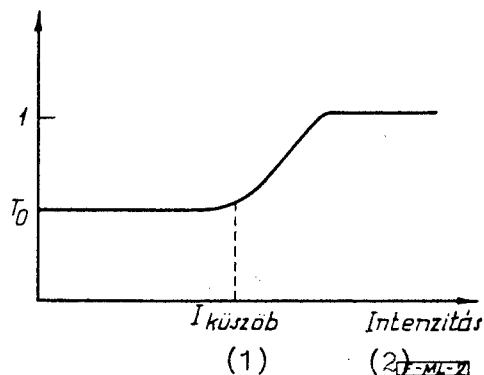
The cost of producing the device is a good bit lower than that of YAG lasers with similar parameters so it seemed worth while studying in what areas it might replace the YAG laser. It was obvious that the parameters produced by the passive and active Q switching modes not only made the phosphate-glass laser equal to similar Nd-YAG lasers but also that in certain cases it surpassed them. We studied--in close cooperation with the KFKI--the possibilities of Q switching, and looked for possible new use areas.

#### Passive Q Switching

It is well known that debasing the Q quality factor of a laser resonator, then quickly switching it back on can produce very brief, high peak output pulses. We speak of passive switching when the field developing in the resonator itself produces the effect which opens the possibility for exit. These are

generally absorbers which are not transparent in the beginning, but the large magnetic field saturates the absorption and the material "opens up" and becomes transparent. The material produces a positive feedback so that a good bit shorter but a good bit more powerful pulse is created at the time of pumping (Figure 2). One can see that the population inversion created by pumping--because of the long duration--can be raised toward a threshold so that there is no laser operation. If we suddenly make the initiation of laser operation possible then--because of an inversion many times greater than the threshold--we get a pulse briefer and many times more intense than the normal pulses.

Figure 2.



Key:

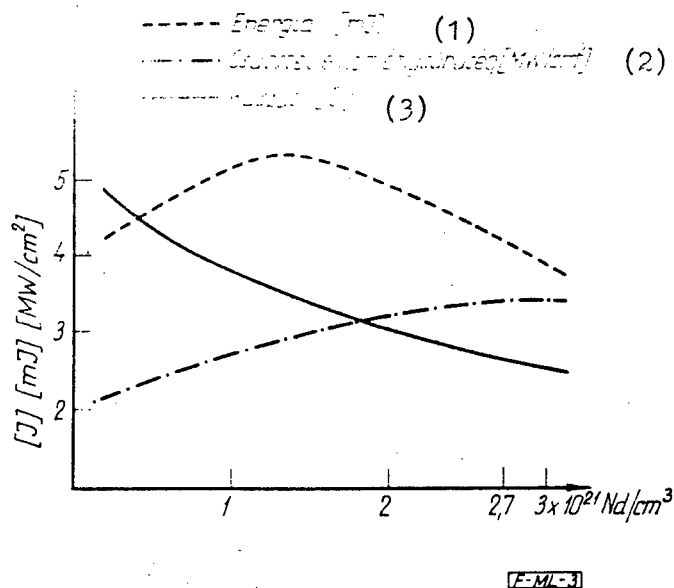
1. Threshold

2. Intensity

We use a very advantageous, unique passive Q switch for the phosphate-glass laser used by us; it is an LiF crystal suitably supplied with  $F_2$  color centers. In the interest of increasing the amplification of the active laser rod we reduced the diameter of the rod to 3 mm and increased the Nd concentration. Figure 3 shows the Nd concentration dependence of the laser parameters. In this way we could attain a pulse width of 12 nsec and a pulse energy of 4.5 mjoules, with 5 joules of pumping energy. (2) It is a special property of the passive Q switch mentioned that simultaneous with the switching there is mode selection acting as an automatic stop number as a result of which the outgoing beam can be given the  $TEM_{00}$  mode. Despite the small resonator length the  $TEM_{00}$  mode radiation results in a divergence of 1-2 mrad. The small divergence and the  $TEM_{00}$  mode make it possible to focus the beam easily so that a large output density can be attained. In the event of properly selected mirror-transmission values and pumping one can produce the signal form needed in measurement technology.

The above advantageous properties--and the low price--make possible the development of such new areas of medical and measurement technology use as special eye surgery, spectroscopy and passive measurement of large distances. (3)

Figure 3.



Key:

1. Energy                      2. Peak output density                      3. Threshold

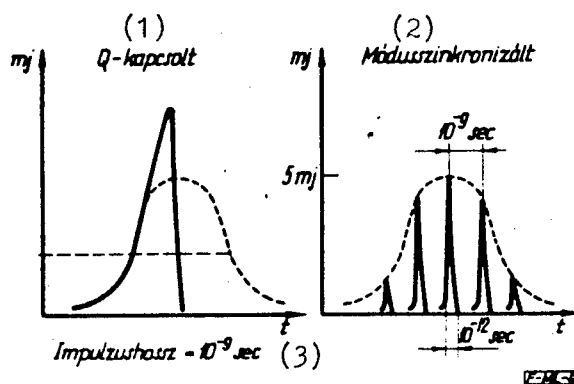
#### Mode Synchronization

One significant requirement for the utility of pulse lasers is that the outgoing pulse be ultra short (subnanosecond) and that the output be in the GW range. Under such conditions the interaction of the laser light and the material is of a different type. (Creation of plasma in biological samples, spectroscopy of ultra fast processes, material separation without melting, etc.)

Mode synchronization of the lasers serves to produce pulses of this type. Figure 4 gives a comparison of pulse time and energy--with a Q switching laser.

In general very many axial modes fit into the amplification curve of lasers. These modes are at a distance from one another of  $C/2L$  in frequency ( $C$ =speed of light and  $L$ =resonator length) but their phases are independent of one another. If we fix the phases to one another then they vibrate in phase only at the place of synchronization; departing from that they weaken or cancel one another by interference. In this way a part of the modes circulating within the resonator exit through the opening mirror at intervals of  $T=2L/C$ , producing a picosecond pulse series. Theoretically the band width ( $\Delta \nu$ ) determines the pulse length, for  $\Delta t \Delta \nu$  is greater than or equal to one (indeterminate relation). But in practice the theoretical value cannot be realized because of the parameters of the modulators (stability, relaxation time).

Figure 4.



Key:

1. Q Switched                      2. Mode synchronized                      3. Pulse length

Theoretically the phosphate-glass laser developed by us offers a favorable possibility for mode synchronization. In practice, in a way similar to the principle of Q switching, the loss introduced by the active modulator must be in synchrony with the circulating time within the resonator. So we must choose a resonator length such that a suitable acousto-optical modulator can achieve synchronization. The situation is simpler in the case of continual operation mode because there is always an internal field. (However, the length of the resonator must be kept stable in regard to the wave length.)

We put forward the following goals:

- pulse width of 500 ps,
- pulse energy about 0.5 mJ,
- pumping energy about 5-6 J,
- divergence about 1 mr, and
- repeat frequency maximum 0.1 Hz.

Our beam will be polarized.

These figures make necessary the solution of two fundamental design problems:

--Phase synchronization of a pulse operating laser, which places a high requirement in regard to swiftness of setting. According to our calculations, with a 100 MHz modulating frequency it must be possible to set to the resonator frequency with a precision of 500 Hz within a few ms.

--Development of a 100 MHz acousto-optical modulator for the 75 cm resonator which seems appropriate.

#### Summary

With the aid of international and domestic cooperation we developed a new type of passive Q switching phosphate-glass based pulse laser which in the case of low repeat frequency has more advantageous properties in many cases than the Nd-YAG laser developed for similar purposes. Its small divergence and TEM<sub>00</sub>

mode beam profile ensure more favorable focusing possibilities than ever before. If mode synchronized operation of this laser is realized it will be without a competitor for certain new use areas, such as eye surgery operations on the vitreous body, to break up binding energies in laser chemistry and to stimulate chemical reactions, for spectroscopic studies of ultra fast processes, producing plasma and for special material structure studies.

It is not necessary to satisfy special requirements in regard to the optical transform systems intervening between the laser ray and the mode of use. The price of the device is significantly lower than that of YAG systems and so it could be competitive on the world market.

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8984

CSO: 2502/87

## HUNGARY: NEW THIN FILM RESULTS, NEW TYPES OF INVESTIGATION

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 5, May 87 pp 133-138

[Article by Dr Mrs Istvan Fluck and Gyorgy Szalai, Central Optics Research Laboratory, Hungarian Optical Works: "Our Developmental Achievements in Optical Thin Films; Introduction of New Investigative Methods." The first paragraph is the Hungarian summary.]

[Excerpts] This article deals with two themes, already used in manufacture, out of the research and development results of the past 8 years in the area of optical thin films. It reviews the research and development process in regard to a family of reflection reducing films and high performance tolerant laser mirrors. It also describes achievements in film structure investigations aiding the solution of technological problems in the course of the research and development activity (SXRS soft X-ray emission spectroscopy, XFS X-ray fluorescent spectroscopy and XRD X-ray diffraction) and the results of damage investigations.

## High Performance Tolerant Laser Mirrors

Because of the increasing need for continual and pulse operating lasers we developed a vaporization technology for high performance tolerant laser resonator mirrors for use with  $\text{Nd}^{3+}$  phosphate and  $\text{Nd}^{3+}$  YAG lasers.

The parameters of the lasers are given below.

$\text{Nd}^{3+}$  mini phosphate glass laser:

- lambda=1055 nm,
- pulse time (length) tau=10-15 nsec,
- beam diameter=2 mm,
- exiting energy=10 mJ,
- estimated energy density on surface of mirror=3 J/cm<sup>2</sup>.

$\text{Nd}^{3+}$ ; YAG, continual operation mode:

- output=100-150 W in multimode,
- beam diameter=3-4 mm.

The usual vaporization technology for  $\text{TiO}_2$ - $\text{SiO}_2$  resonator mirrors which ensure outstanding quality (R equal to or greater than 99.84 OMH in the case of the closing mirror, Jena ZEISS measurements) in the case of He-Ne lasers did not ensure a sufficiently large damage threshold value in the near infra wave length range and the mirrors frequently burned out.

To solve the problem we studied the destructability of mirrors made with other hard dielectric materials as a function of the materials and the vaporization parameters. We did structure studies on  $\text{TiO}_2$  and  $\text{SiO}_2$  films and on  $\text{TiO}_2$ - $\text{SiO}_2$  mirrors. We studied the relationship between structure, destructability and the vaporization parameters with spectroscopic methods.

We vaporized the samples (the initial materials were  $\text{CeO}_2$ ,  $\text{Ti}_2\text{O}_3$ ,  $\text{ZrO}_2$  and  $\text{Ta}_2\text{O}_5$  high refractive index and  $\text{MgF}_2$  and  $\text{SiO}_2$  low refractive index materials) in BAK 760 E and BA 710 Balzers vacuum vaporization equipment with 1.5-3 kW output from an EKS 110 electron gun. The BALZERS AG provided all the materials used. For thickness measurement we used a QM 101 vibrating quartz thickness meter. We used BK 7 glass as the substrate glass material for the samples.

We performed the following tests on the samples:

--Measurement of optical parameters (reflection and transmission measurements) on a BECKMANN ACTA M VII spectrophotometer.

--We computed the refraction index values from the measured data. (We found no optically measurable absorption in the samples in either the visible or infra range.)

--SXES; soft X-ray emission spectroscopy; we stimulated the material with electron bombardment to emit X-ray radiation.

--XFS; X-ray fluroescent spectroscopy; we stimulated the material with primary X-ray radiation to emit secondary X-ray radiation.

--SXDA; soft X-ray depth profile analysis.

--XRD; X-ray diffraction (DRON III).

--TEM; transmission electron microscopy (TESLA BS 540).

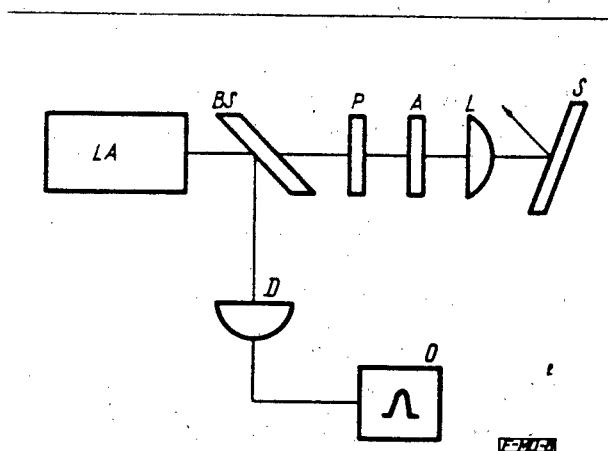
--SEM; scanning electron microscopy (JEOL 255 II).

--Damage studies; the arrangement can be seen in Figure 8.

In most cases the film structure was determined with XRD and chemical analysis was done with SXES and XFS. From the SXDA studies we learned the chemical bond distribution not only on the surface but inside the layers as well. (We measured the  $\text{TiK}_{\alpha}$ ,  $\text{TiL}_{2,3}$ ,  $\text{TiL}_1$ ,  $\text{SiK}_{\alpha}$ ,  $\text{SiK}_{\beta}$ ,  $\text{SiL}_{2,3}$  and  $\text{OK}_{\alpha}$  spectra.)



Figure 8.



We performed the damage studies in a dark room with visual observation. We "shot" the samples at one point each with laser pulses until the first damage but at least until there had been 40 pulses. We regulated the energy of the pulse series by changing the angle of the analyzer. In the  $TEM_{00}$  mode the energy of the laser was 10 mJ plus or minus 10 percent, the length of the laser pulse was  $\tau=10-15$  nsec, the diameter of the laser beam was 2 mm, the repeat frequency was 1 Hz and using a collecting lens with a focal distance of 100 mm the energy at the focus was  $E=26 \text{ J/cm}^2$ .

We performed the damage studies on  $CeO_2$ ,  $TiO_2$ ,  $ZrO_2$ ,  $Ta_2O_5$ ,  $MgF_2$  and  $SiO_2$  materials or rather on mirrors made of them. Table 1 contains the vaporization parameters and Table 2 contains the results of the damage studies.

It can be seen from Table 2 that the damage threshold value for  $TiO_2$  is rather low, but as a material with a high refractive index it can be used very advantageously as a material for the closing mirror of laser resonator mirrors.

It was necessary to establish what causes the destruction threshold value,  $1.2-2 \text{ GW/cm}^2$ , in  $TiO_2$  films.

Depending on the vaporization parameters we found  $TiO_2$  films in amorphous, anatase and rutile phases.

We measured the short-range order of  $TiO_2$  with the XFS method and determined it from the  $TiK_{\alpha}$  emission spectrum.

The ratios of the various phases depend on the partial pressure of oxygen and on the heat treatment.

Table 1. Vaporization Parameters

Párolgatási paraméterek							
Réteg- anyag	(1)	Kiinduló anyag	(2)	Vastagság, (3) [nm]	Sebesség, (4) [nm/sec]	Oxigénnyomás, (5) [mbar]	Törésmutató (6) $\lambda = 1064 \text{ nm-en}$
MgF <sub>2</sub>		MgF <sub>2</sub>		192	0,6	—	1,38
				910	0,8	$0,8 \cdot 10^{-4}$	
				910	1,8	$2,2 \cdot 10^{-4}$	
SiO <sub>2</sub>		SiO <sub>2</sub>		180	0,8	$0,8 \cdot 10^{-4}$	1,45—1,47
				180	1,8	$2,2 \cdot 10^{-4}$	
CeO <sub>2</sub>		CeO <sub>2</sub>		133	0,3	$2,0 \cdot 10^{-5}$	2,00
				108	0,15	$2,2 \cdot 10^{-4}$	2,24
TiO <sub>2</sub>		Ti <sub>2</sub> O <sub>3</sub>		108	0,6	$4,8 \cdot 10^{-4}$	2,20
				324	0,6	$4,8 \cdot 10^{-4}$	2,20
				137	0,15	—	1,93
ZrO <sub>2</sub>		ZrO <sub>2</sub>		143		$5,0 \cdot 10^{-5}$	1,85
				135	0,12		1,97
Ta <sub>2</sub> O <sub>5</sub>		Ta <sub>2</sub> O <sub>5</sub>		134	0,24	$3,0 \cdot 10^{-4}$	1,98

(— maradék gáznyomás  $5 \cdot 10^{-6}$  mbar,  $T_s = 350^\circ \text{C}$ ) (7)

Key:

1. Film material
2. Initial material
3. Thickness (nm)
4. Speed (nm/sec)

5. Oxygen pressure (mbar)
6. Index of refraction  
( $\lambda = 1064 \text{ nm}$ )
7. Residual gas pressure  $5 \cdot 10^{-6}$  mbar,  
 $T_s = 350$  degrees Celsius

Table 2. Results of Damage Studies

A roncsolásvizsgálatok eredményei	
Vizsgált rétegrendszer (1)	A sérülést okozó lézer teljesítménysűrűség, (2) GW/cm <sup>2</sup>
MgF <sub>2</sub>	> 6,5
SiO <sub>2</sub>	> 6,5
CeO <sub>2</sub>	1,8—3
TiO <sub>2</sub>	1,2—2
ZrO <sub>2</sub>	6,5
Ta <sub>2</sub> O <sub>5</sub>	> 6,5
TiO <sub>2</sub> —SiO <sub>2</sub>	1,2—2
CeO <sub>2</sub> —MgF <sub>2</sub>	1,8—3,0
ZrO <sub>2</sub> —MgF <sub>2</sub>	6,5
ZrO <sub>2</sub> —SiO <sub>2</sub>	6,5
Ta <sub>2</sub> O <sub>5</sub> —SiO <sub>2</sub>	> 6,5

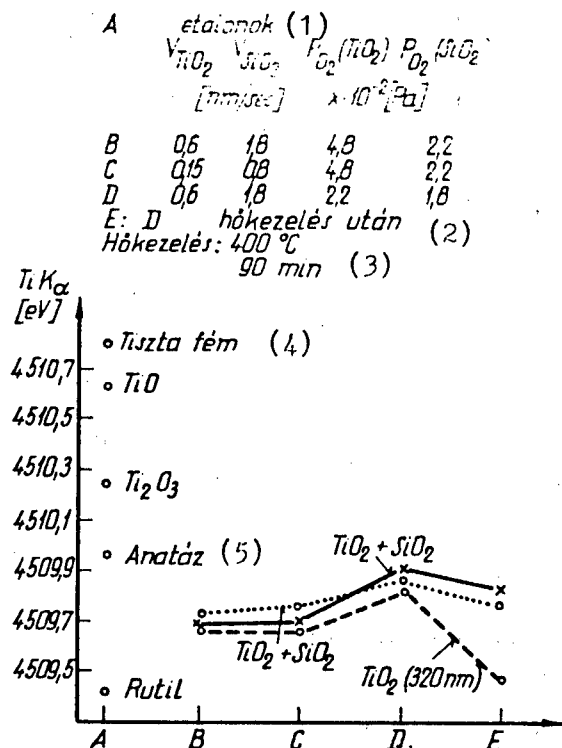
Key:

1. The film system studied

2. Power density of the laser causing  
the damage, GW/cm<sup>2</sup>

The short-range order of amorphous phase  $\text{TiO}_2$  shows mixed anatase-rutile symmetry. Increasing the partial pressure of oxygen and the heat treatment help the development of the rutile type short-range order in the film. In Figure 9 we see the  $\text{TiK}_{\alpha}$  spectrum peaks in the case of various parameter values. According to our studies the damage threshold value decreases with a reduction in the partial pressure of the oxygen.

Figure 9. Peak Positions of the  $\text{TiK}_{\alpha}$  Spectra



Key:

- |   |               |
|---|---------------|
| 1. Standards                            | 4. Pure metal |
| 2. After heat treatment                 | 5. Anatase    |
| 3. Heat treatment: 400 degrees, 90 min. | 6. Rutile     |

Table 3 contains the results of the structure and damage studies. It can be seen from the table that in a  $\text{TiO}_2$  film the higher damage threshold value belongs to a rutile type short-range order film. Both an oxygen remnant gas increase and heat treatment favor the development of rutile type symmetry. The result that a greater damage threshold belongs to the rutile phase is not surprising for the infrared absorption of the rutile phase is smaller than that of the anatase phase, as can be seen in Figure 10.

Table 3. Results of Structure and Damage Studies

## A szerkezet és roncsolásvizsgálatok eredményei

Minta (1)	Vastagság [nm] (2)	Lézer energiasűrűség [GW/cm <sup>2</sup> ] (3)	Fázis (4)	PO <sub>2</sub> [mbar]	v [nm/sec]	Ts [°C]
SiO <sub>2</sub>	910	> 6,5	amorf (5)	0,8 · 10 <sup>-4</sup>	0,8	350
SiO <sub>2</sub>	910	> 6,5	amorf	2,2 · 10 <sup>-4</sup>	1,8	350
SiO <sub>2</sub>	910	> 6,5	amorf	1,8 · 10 <sup>-4</sup>	1,8	350
TiO <sub>2</sub>	324	1,1	anatáz (6)	2,2 · 10 <sup>-4</sup>	0,15, 0,6	350
TiO <sub>2</sub>	324	1,8	anatáz	4,8 · 10 <sup>-4</sup>	0,6	350
TiO <sub>2</sub>	324	2,0	rutil (7)	4,8 · 10 <sup>-4</sup>	0,15	350
TiO <sub>2</sub> -SiO <sub>2</sub>	108	1,2	TiO <sub>2</sub> anatáz (8)	2,2 · 10 <sup>-4</sup>	0,15, 0,6	350
	182		SiO <sub>2</sub> amorf	1,8 · 10 <sup>-4</sup>	0,8, 1,8	350
TiO <sub>2</sub> -SiO <sub>2</sub>	108	2,0	TiO <sub>2</sub> rutil	4,8 · 10 <sup>-4</sup>	0,15, 0,6	350
	182		SiO <sub>2</sub> amorf	2,2 · 10 <sup>-4</sup>	0,8, 1,8	350

## Key:

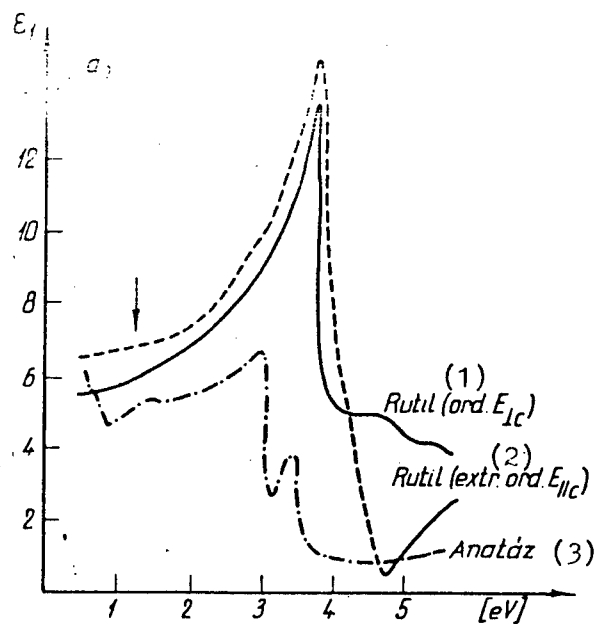
- |   |                                  |
|---|----------------------------------|
| 1. Sample                                     | 5. Amorphous                     |
| 2. Thickness (nm)                             | 6. Anatase                       |
| 3. Laser energy density (GW/cm <sup>2</sup> ) | 7. Rutile                        |
| 4. Phase                                      | 8. TiO <sub>2</sub> anatase etc. |

The results of the damage and structure studies showed that a rutile type short-range order characterizes the most favorable TiO<sub>2</sub> structure. Of the vaporization parameters the partial pressure of oxygen has the greatest influence on the phase ratios which develop in the TiO<sub>2</sub>. In addition to a high PO<sub>2</sub> pressure the heat treatment done in air also helps to increase the ratio of the rutile phase.

The structure tests were done at the Solid Body Physics Faculty of the Lorand Eotvos Science University; the damage studies were done at the KFKI [Central Physics Research Institute].

The authors take this occasion to thank their colleagues for their active cooperation.

Figure 10. Refraction Indexes of Rutile and Anatase Phases of  $\text{TiO}_2$  (real and imaginary part), (rutile monocystal, anatase anode film)



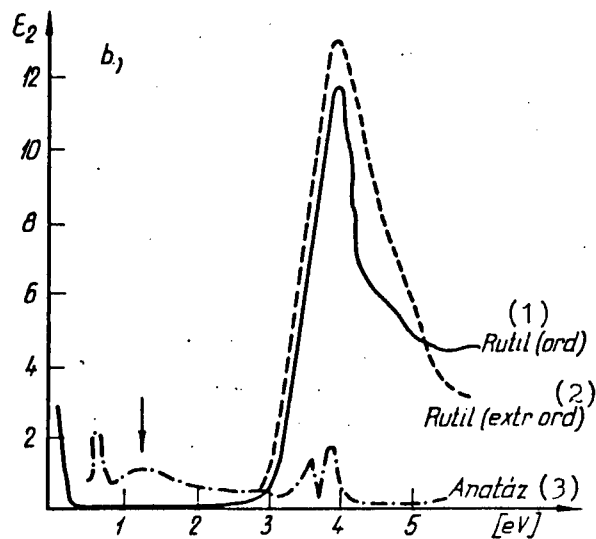
Graph a.

Key:

1. Rutile (ord  $E_{Ic}$ )
2. Rutile (extr. ord  $E_{IIc}$ )
3. Anatase

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Graph b.

Key:

1. Rutile (ord)
2. Rutile (extr. ord)
3. Anatase

HUNGARY: SECRETARY ON ACADEMY OF SCIENCES FINANCES, OPERATIONS

Budapest MAGYAR TUDOMANY in Hungarian No 6, Jun 87 pp 445-454

[Article by Istvan Lang, member of the MTA (Hungarian Academy of Sciences) and first secretary of the MTA: "Status and Forecast", based on a speech given at the 1987 general assembly of the MTA.]

[Excerpt] Academy Resources

At the beginning of the plan period the material resources actually available were smaller than we had calculated earlier. Thus the economic conditions for research deteriorated further. The budgetary support--not counting the OTKA [National Scientific Research Fund]--for running the Academy research institutes in 1986 was 940 million forints, showing a decrease of about 1.6 percent compared to the plan and a 6.2 percent increase compared to the actual figure for the preceding year.

The income of the research institutes themselves was 2,706 million forints in 1986, which is three times the direct budgetary support. These figures illustrate well that to an ever greater degree the institutes depend on both so-called state commissions and enterprise commissions. Without the commissions financed from enterprise sources the existence of many institutes could become questionable.

It represented a problem for us that despite the intentions our participation in the "G" programs of the OKKFT [National Medium-Range Research and Development Plan] was not on the scale we would have liked. There was a change compared to the beginning so that the environmental protection and nuclear energetics programs could get started or be continued. It was reassuring that for the most part our social science institutions succeeded in signing state commission contracts within the framework of the OKKFT.

Several of our large institutes undertook research on themes for which they had a significant intellectual base but for which adequate material resources were not available. Some of these themes also served technical development. Successful discussions took place and are taking place whereby the KFKI [Central Physics Research Institute] and the Central Chemical Research Institute will receive financing from reserve funds of the OMFB [National Technical Development Committee] amounting to about 150-200 million forints

for themes which meet OMFB criteria. We express special thanks for this supplementary support.

In 1986 also the institutions made significant use of reserve moneys generated in preceding years. These sources were exhausted by this year. For 1987 Academy researchers received nearly 174 million forints within the OTKA framework under the heading of operational costs arising from theme competitions, 60 million under the heading of investment costs and 10.5 million for acquisition of computer technology tools.

As for our investment possibilities, actual investment use in 1986 was 840 million forints, including 350 million forints from the central investment allowance, 60 million forints from computer technology moneys handled by the KSH [Central Statistics Office] and 90 million forints from the major renovation allowance used for reconstruction. The rest came from other sources within the decision sphere of the institutes. Two factors influence use of the 416 million forints available from central investment allowances in 1987. One is that the construction investments and research programs begun earlier on the basis of prior decisions must be continued. The other limiting factor is that for 1987 we have available 154 million forints less than the investment prescribed by the Seventh 5-Year Plan. So we can turn 172 million forints to reconstruction of the nuclear reactor, a good bit less than the original plans, leaving 135 million forints for instrument investments and other purposes.

I can report the following to the general assembly concerning construction in progress.

Construction of the Library is proceeding essentially as planned despite many difficulties. Technical delivery can be expected in April of next year. It will be a good feeling to say then that the new building of the Library is ready and can soon be used.

Reconstruction of the nuclear reactor has begun. It will require at least 2 years to be completed.

The minor laboratory expansion at the Veterinary Sciences Research Institute will be completed this year, as will the greenhouse for large plants at the Ecological and Botanical Research Institute.

The conversion of the Erdotarca Castle into an Academy facility is proceeding well. This work will be completed by the summer of next year.

On 26 May we will dedicate in Gyor the renovated building of the Northern Transdanubian Department of the Center for Regional Research.

In 1986 we issued more foreign exchange permits for investment than we did in the preceding year. The reason for the increase is partly that at the initiative of the deputy prime minister the National Plan Office significantly increased our foreign exchange allotment with the 25 million forints special purpose support given for development of the Instrument Affairs Service. The possibilities were also increased by the OTKA foreign exchange allotment and

by the special support received for measures which became necessary in connection with the Chernobyl events. Our investment foreign exchange allotment is expected to be 93 million forints for 1987. We must use this primarily to buy machines and instruments.

An important element of management is how we can support international scientific contacts. The Academy budget which can be turned to international contacts in 1987 shows a nominal increase. Unfortunately we know that this is far from making possible satisfaction of the justified needs in this area. The MTA continues to have a significant number of exchange frameworks fixed in 53 bilateral agreements. The most dynamically expanding form of travel since 1986 has been individual invitations and employment.

Comparing the national data to Academy trips we see that the ratio of travel by Academy researchers is twice the national average. This is not done to the detriment of others but rather is the result of our own organizing work and the regrouping of our own material resources. This international mobility is justified by, among other things, the role undertaken by the MTA in, for example, non-governmental international scientific organizations. Out of more than 600 such organizations supervision and taking care of the maintenance of contacts for 225 falls on the Academy; and this requires travel involving primarily non-ruble accounting foreign exchange. In 1986 the MTA could provide 1,800,000 forints in non-ruble accounting foreign exchange for travel out of its budget. In 1987 approximately the same amount will come from the central budget for this purpose. But now nearly the same amount will come from the OTKA for foreign missions.

Central conservation measures have been taken this year in the interest of reducing the deficit of the state budget. As a whole these caused a reduction of about 6-7 percent. With this we have come to the limit of the tolerance of the institutional system. If additional such constraints are imposed we will be forced to a drastic reduction in the area of undertaking tasks.

#### Development of Contacts Between Academy and Universities

Among the science organization tasks of the near future a special role will go to initiatives and measures aiding the cooperation of research sites and institutions of higher learning and aiding a partial integration which will increase efficiency. In the near future the Science Policy Committee will discuss our proposals, presented by the president of the Academy, pertaining to strengthening the system of contacts between higher education and research, proposals which we prepared in cooperation with the affected higher education authorities and the Ministry of Industry. We approach this task very seriously, with the intention of taking the initiative, and we have already received very significant help for this from the leaders of the Academy research sites. Satisfying my request, the present contacts between the institutes and the universities have been described in a many-sided and very informative way.

There is not a single institute not ready to declare itself most open to further cooperation. Our existing contacts, in organized form and in their spontaneous manifestations, are imposing. This is proven by facts which can be



expressed in figures as well. An intent has also been expressed to increase cooperation in the areas of both training and research despite the increasingly limited resources--or, indeed, in many places under the pressure of this.

They consider it important to deepen the existing contacts, which is manifested in joint competitions, research themes, undertakings, joint development and use of the infrastructure, joint programs, in the course of professional communication, in participation in graduate and postgraduate training and in more and more places in the development of rationally organized cooperation frameworks. The formation of the Debrecen Physics Center is a good example of the latter.

But increasing cooperation cannot become a goal in itself. We must avoid every solution which acts counter to worthy, substantive rationality and increasing efficiency and degrades the cause of cooperation or partial integration into questions of supervisory rights and other administrative or financial problems. We must also avoid solutions which take a generalizing approach or are forced from above, evoking significant resistance. On the other hand we should support the deepening of existing cooperation, aiding the spread of proven contact forms, the elimination of legal, regulatory and other factors hindering cooperation or making it difficult and every local initiative embodying a small step or gradual progress in the direction of the basic goal.

In his debate initiating speech our president spoke of this question already. I evaluate the methods and possibilities of further progress in exactly the same way. We know that we must create something qualitatively new and different in contacts between the Academy and the universities. These two spheres together represent the crucial part of domestic research. Joint action could represent a very great force in the interest of research. In regard to the years ahead our position and the position of the leaders of the Ministry of Culture can be summarized as follows:

a. Both organizational systems, the universities and the Academy research institutes, will maintain their independence and on this basis--within the framework of a system of concrete cooperation agreements--they will develop their cooperation further. This does not exclude the possibility that after sufficient study there may be minor organizational restructuring as well.

b. The development of cooperation and raising it to a qualitatively higher level must extend to all three functions--education, postgraduate training and research.

c. Communication between universities and research institutes, the exchange of information and many-sided cooperation must be aided by central chief authority measures and by the embracing of local initiatives, striving for optimal exploitation of the intellectual and material base by harmonizing research thematics or by a thematic division of labor.

d. The differences appearing in the operational mechanism, regulation and other conditions of the two institutional systems must be reduced in areas connected with financial management, cadre policy, wage payment and managing

international contacts. Regulations and decrees which hinder cooperation must be reviewed.

e. Rational coordination must be realized in acquiring and using research tools; on occasion mutual access must be ensured on a shares basis.

These principles are in complete harmony with valid party and government resolutions and positions. I would like to add, as the opinion of the Academy, that we want to maintain and are even ready to expand the present system of support for university research, primarily in the case of those faculties led by academicians and doctors of science where the thematic conditions are given for linking into the research programs of the Academy. We regard the existing and well functioning university-academy research groups as organic parts of university research which also serve the research interests of the Academy.

But one might ask, "What about 3-4 years from now?"

I answer that I do not know what sort of research guidance macrostructure will be optimal in the 1990's, but it would be useful to think about this in a circumspect way and avoid any confusion or improvization in making the decisions.

#### Contact Between Academy and Enterprises

A recognition of mutual interest might be the first step in making our enterprise contacts closer. A good foundation for this is provided by the fact that at the end of last year the Central Committee debated closely interdependent questions pertaining to accelerating technical development and increasing the effectiveness of scientific research. The communique issued emphasized the fact that to a large extent scientific research determines the level of technical development necessary to increase the competitiveness of the Hungarian people's economy. For this reason we must develop cooperation between research institutes and enterprises based on mutual interest for the practical utilization of the results of scientific research.

Marketing and producing enterprises are the arena for the realization of technical development and to an increasing extent market interests regulate the interest relationships. Since the generation of the obligatory technical development fund will end at the enterprises they will decide independently how much to turn to research and development. It follows that there will be an increased demand for the effectiveness of research and for use of the achievements and that there will be harder requirements in the case of research contracts financed from the enterprises' own funds. Knowing the above it appears good that we try to encourage at every possible forum the effective, useful cooperation, advantageous to both sides, of Academy research institutes and enterprises. For this purpose we have started a series of conversations within the framework of which we intend to visit about 10-15 large industrial and agricultural enterprises. This has already begun. We also invited to our general assembly the leaders of those enterprises on whose cooperation we especially count in the future.

Experiences thus far show that the present volume of cooperation is relatively modest and far below the possibilities. Among other things the reason for this is that we incompletely understand each other's work, sphere of activity and achievements; developmental sources have narrowed and there are certain conflicts of interest between the enterprise and research sphere.

Despite all this there is a readiness on both sides for expansion of cooperation. The enterprises showed great interest in conducting joint research and development activity in those cases where the participating institutes and enterprise collectives might share jointly from the profit of the result.

Special mention should be made of the fact that meetings with similar themes took place between individual groups of Academy institutes and the leaders of cooperatives belonging to the OKISZ [National Federation of Artisan Cooperatives]. These meetings led to concrete results in the course of which a number of research results found realization or use in the sphere of the interested cooperatives.

In the period since the last general assembly the Academy has expanded its existing contractual contacts with a number of ministries and organs with national authority or has signed new cooperation agreements. The earlier contacts, which worked well in practice, and the lower level agreements were expanded and raised to the ministry level with the ministries of construction and urban development, industry and defense and with the Hungarian Chamber of Commerce. We renewed our agreements with the MTESZ [Federation of Technical and Scientific Associations], the Ministry of Agriculture and Food and the Ministry of Health.

#### Status of Academy Book and Journal Publication

Our president has already spoken of this question in detail. For my part I add the following. Following the extraordinarily difficult years 1984-85, when the Academy Publishers were on the verge of going into receivership, the economic losses were reduced in 1986. But the basic economic contradiction did not end; the Publishers must satisfy the publication needs of the Academy while also satisfying the requirements of enterprise regulation. It is certainly a help that recently the state subsidy was raised from 43 million to 58 million forints.

When planning the 1986 activity of the enterprise the basic conception or goal specified satisfaction of the scientific book publishing plan set by the MTA, maintaining the level of journal publication, constant improvement of the technical state of the printing machine park in accordance with the material possibilities, compensating with more intensive market organizing work for the sales receipts lost during reconstruction of the Vaci Street bookshop and, last but not least, the continual uncovering of the many reserves in costs and inventory management.

Progress has been made on some of these goals. But the results achieved are far from sufficient. An idea the essence of which is that the institutes should be made suitable for using text editing computers to prepare print-

ready manuscripts and that there should be sufficient capacity for the other phases of work could mean an expansion and acceleration of publishing possibilities. In this connection there was a survey of the duplicating plant of the MTA and a study of the possibilities for expansion. It appears that this could represent relatively swift aid for a solution of the most burning problems.

Let me repeat the idea which our president put forward and which was formulated at leadership meetings: One of the largest Academy investment and renovation undertakings of the next 5-year plan could be a technical modernization of the [Academy] Press. This would solve many problems for the next 20-25 years, but obviously it would require certain sacrifices, for example in the area of institute reconstruction. We need not decide yet, but thinking about it and a many-sided consideration of it should certainly start.

#### Experiences Connected With OTKA [National Scientific Research Fund]

As chairman of the OTKA Committee I have satisfied my reporting obligation at a number of forums in months past. In the interest of a further exchange of ideas I hereby summarize experiences connected with its functioning thus far and ideas affecting the future of the competition system.

The initial experiences with the OTKA can be called unambiguously favorable. In a number of areas, especially in the smaller university and college faculties, the OTKA represents the first considerable source of money for financing research in a long time. In those larger institutions which are in a relatively better material situation, in supporting basic research for example, the OTKA confirms the winning researchers in the correctness of their theme selections and makes possible research on important themes which could not be undertaken without this support.

From the viewpoint of research guidance we consider it very important that thanks to the OTKA competition has become sharper among domestic researchers and between the several research areas and themes. We are convinced that if the basic principles of the OTKA are realized then it too could be a tool in the hands of decision makers who consider it important to distribute resources according to quality and to realize selectivity.

Scientific public life, the great majority of researchers, approve of and agree with the general principles of the OTKA and consider the decisions realistic, but in many respects they also criticize the practice thus far. We can hardly change the size of the allotments, but much also depends on the method of use, where we might be able to make improvements. In part a number of other changes also depend on us. We might regard as such, for example, strengthening a more independent institutional character of the OTKA, treating it as a foundation; creating harmony in time and possibly in content between the OTKA and other competition forms; developing a mechanism for a continual competition; publishing the operational regulations of the OTKA; simplifying the management of affairs, etc. It would be useful to develop an organizational, institutional background for the operation of the OTKA which aids in a professional manner the conduct of the competition from announcement to evaluation and granting awards.

Between the general assemblies of last year and this nearly 3.5 billion forints [as published, 350 million seems a more likely figure] was distributed to theme competitions and development of the research informatics infrastructure, creation of 11 instrument centers and improving central services (such as instrument loans). The OTKA Committee made these decisions unanimously; we brought in a very broad sphere of experts to help prepare the decisions and we regularly informed public opinion about the decisions. We forced no criticism or comment into the background.

The experiences thus far in conducting the theme competitions make it urgent to ensure foreign exchange allotments in a proper ratio in the remaining years of the plan period. Without this the completion on the planned schedule of research tasks already approved becomes dubious. We must solve the year by year evenness of investments and we will develop a concrete proposal for the regrouping of them by the middle of the plan period.

It is absolutely necessary to have final ideas and rules for the system of evaluating results by the fall of this year. This is justified by the interdependence of evaluations with the interest system of theme leaders and cooperating parties.

The second theme competition of the OTKA must be prepared by the middle of 1987. About 300 million forints out of the Seventh 5-Year Plan OTKA assets will provide cover for this. The Science Policy Committee has already decided to supplement this sum by 100 million forints out of the Eighth 5-Year Plan OTKA funds, and the time limit for support can be set in the 4 years between 1988 and 1991. For the first time we will step over the walls between two 5-year plans, previously thought unbreachable.

The experiences in signing contracts strengthen the need to finalize the regulation of the operational system of the OTKA in the light of experiences thus far. It would be useful if the regulation also codified the use of supports won in the course of infrastructural competitions and set additional prescriptions pertaining to the evaluation of results and the interest of various parties.

The success of the OTKA competitions thus far and the development of professionally well founded decisions was made possible in the past year by the very great and intensive work of our Academy and of the cooperating ministries. At the general assembly of our Academy I would like to express my thanks and recognition to the bodies and colleagues of the MTA, the more than a thousand cooperating scientists and experts, the leaders, bodies, colleagues and officials of the ministries, the OTKA Office, the main departments of the MTA Research Organization Institute and Central Office and not least of all to the leaders and collectives of the research sites. Without such unparalleled joint action by science guidance and scientific public life it would have been impossible for us to realize the new science policy, research guidance and research financing goals of the OTKA. I ask their continued professional and active support for the operation of the OTKA and for developing an evaluation of results.

## Research Evaluation Efforts

The operation of the OTKA has also strengthened the requirement that science guidance and researchers deal methodically with a regular and concrete evaluation of our work. This science policy trend also corresponds to an international trend. The most striking change in the science policy of the most developed countries in the first half of the 1980's was that with the increase in R and D expenditures the question of orienting and evaluating research financed from the state budget came to the fore.

In general the goal of the evaluation efforts is to distribute the available material and intellectual resources more rationally and purposefully. When weighing these things they try to take into account the external effect of scientific activity and the scientific value of the given research.

It is well known that such an evaluation has numerous pitfalls. For this very reason we can regard as most important even today the evaluation of the scientific community, in its international connections so far as possible. Despite the methodological difficulties there is also a need for some sort of external control, and to an increasing extent the researchers themselves accept and even demand this.

The role of the Academy in guiding national research justifies our taking an active role in developing a system which can be used to evaluate domestic research. The task is not without antecedents. At its annual general assemblies the Academy regularly reports on its work and achievements and outlines its problems and tasks, before a broad professional public and with national publicity. The several ministries also regularly evaluate the research supported by them. The market, and everyone who orders this or that research, evaluates and passes judgment. The Scientific Qualifications Committee evaluates when it classifies researchers. Based on these and the international experiences we must find forms and methods in the near future which will be suitable for judging and even measuring both the research process and the results achieved. But we must emphasize that it would not be useful to force a uniform mechanism on research taking place in different areas and within different frameworks. We regard it as one of our most important tasks to find in addition to the generally applicable forms those elements which appear most suitable in a given area to judge the quality and expected effect of research.

The general assembly last year formulated a number of tasks which in part determine the tasks of the present and near future. In the time which has passed since we have tried, in cooperation with the bodies, to take those steps which can contribute to improving the general conditions for scientific research and Academy research therein and to doing additional effective work.

A year ago it was absolutely clear that in 1987 we would have to review the results of the past 5-year period. We do not yet have such clear ideas in regard to next year's general assembly. But we must start thinking about this now. One possible alternative is a substantive review of the new tasks and responsibility falling on the Academy in national guidance of basic research and the social sciences research figuring in state plans. But certainly there will be other suggestions as well. It would help a great deal if something were said about this in the course of the debate.

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